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TOPICS

GREAT FALLS

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GREAT FALLS, MONTANA

GREAT FALLS "TOPICS" PLAN

1970-1971

Prepared For:

The Montana Highway Commission, Planning Survey Section, and The City of Great Falls.

In Cooperation With:

The U. S. Department of Transportation, Federal Highway Administration.

By:

Small, Cooley and Associates, Inc.
Denver and Great Falls

The opinions, findings, and conclusions expressed in this publication are those of the authors and not necessarily those of the Federal Highway Administration.

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CHAPTER 1

INTRODUCTION

GENERAL:

The City of Great Falls adopted in 1965 a long-range transportation plan, outlining needed improvements to the transportation system within the Great Falls area through the year 1981. This plan outlined requirements for upgrading the major street system and improving the terminal facilities to adequately handle the projected traffic volumes.

The Great Falls Area Transportation Plan was based on data collected and projections made in 1961 by the Montana State Highway Commission, Planning Survey Division, in cooperation with the U. S. Department of Commerce, Bureau of Public Roads, and the City of Great Falls. An in-depth update study of the Transportation Plan was undertaken in July, 1967. The Update Plan made additional recommendations. They included changes in the Study Area Boundary, additional major facilities such as the South Bypass, that would be required to relieve specific problem areas and a review of the location, capacity and structural conditions of the various bridges serving the Study Area.

Information from the original transportation plan and the recently completed update study were used throughout this study, which involved improvements to the existing major street system to increase capacity and to improve safety. The procedures followed were based on Federal Highway Administration Policy and Procedure Memorandum No. 21-18, U. S. Department of Transportation, Federal Highway Administration, Bureau of Public Roads, January 17, 1969, as amended.

SCOPE:

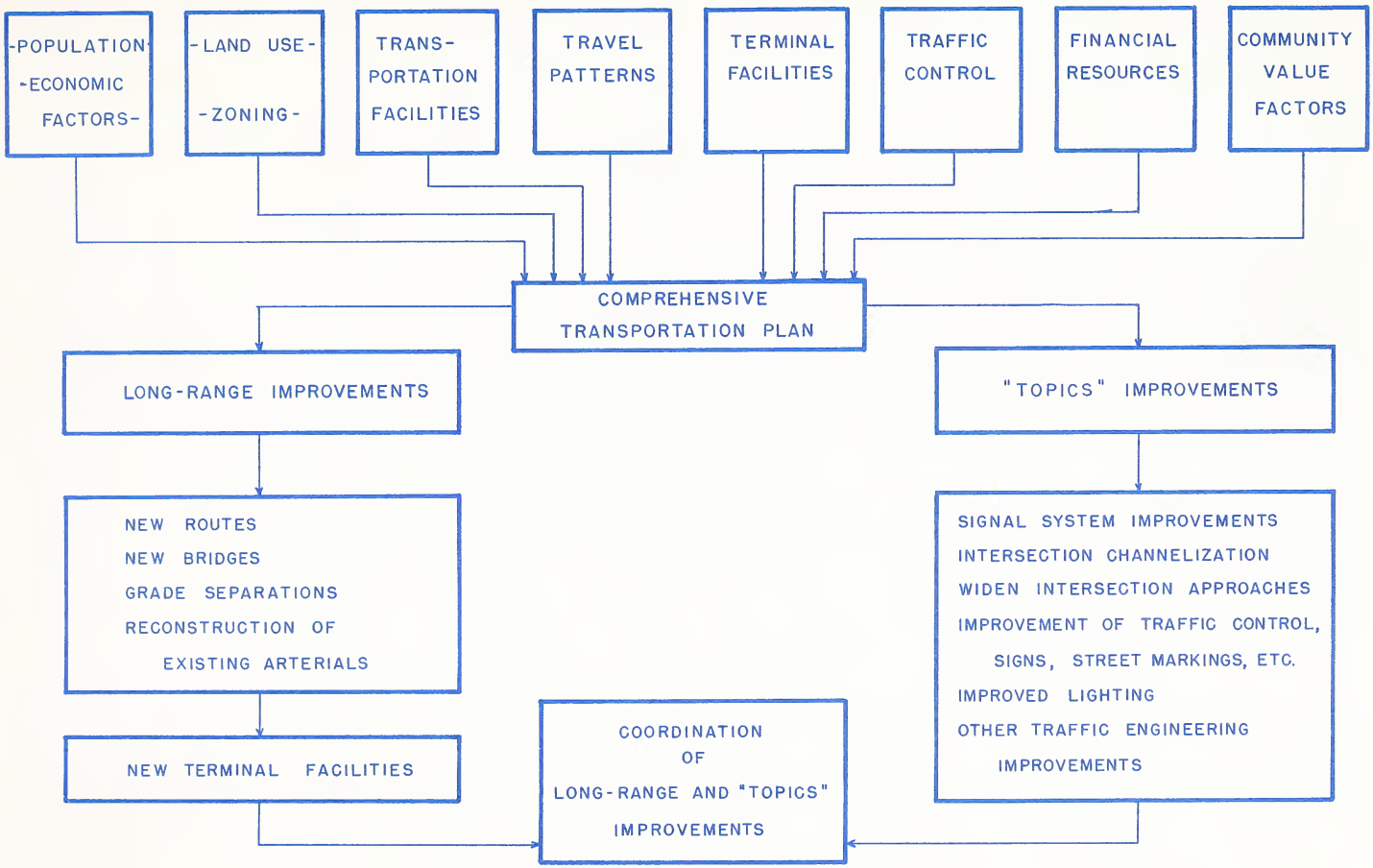
This Study reviewed the existing major street operating conditions, outlined the major problem areas and developed a schedule of improvements to implement specific recommendations for increasing capacity and improving safety.

The intent of "TOPICS" was to provide an improved level of service with a minimum outlay of capital funds and to maximize the efficiency of the existing street system. "TOPICS"-type improvements were generally confined within existing rights-of-way and involved applications of improved traffic engineering techniques.

The role of "TOPICS" in the continuing urban transportation planning process is shown in Exhibit 1, page 7.

EXHIBIT I

ROLE OF "TOPICS"



OBJECTIVES:

The "TOPICS" Plan defined a system of streets and highways including, in addition to existing Federal-Aid Primary Type I and secondary systems, an additional Federal-Aid System known as a Primary Type II System which includes links of the major street network that are not presently designated as Federal-Aid routes. The Type II System, in conjunction with the Primary Type I and Secondary Systems, forms a logically connected network of metropolitan area routes carrying the major portion of traffic in the area. The Type II System includes:

A. Arterial highways and major streets (radial, cross-town and circumferential).
B. Portions of the street grid system in the Central Business District.
C. A limited street grid in other areas having particularly heavy concentration of traffic.

STUDY ORGANIZATION:

The "TOPICS" Study utilized the organization implemented for the Transportation Plan Update. Exhibit 2, Page 9, shows the involvement of the various agencies. The Technical and Policy Committees were made up of members that served in these capacities during the recent Transportation Plan Update Study.

The "TOPICS" Study Approach is shown in Exhibit 3, Page 10.

STUDY AREA:

The "TOPICS" Study Area was the same as for the recent Transportation Plan Update, as shown in Exhibit 4, Page 11. The Study Area included approximately 55 square miles and contained a total of 130.8 miles of major roadways on the initial study system.

STUDY SYSTEM:

The study system is shown in Exhibit 4 and is composed generally of the major street network. This system is composed of:

Interstate Highways	9.0 miles
Primary Type I	31.1
Primary Type II	73.8
Federal-Aid Secondary	16.9
Total	130.8 miles

This study system was selected on the basis of existing conditions. Subsequent analysis resulted in numerous changes to the existing study system which are outlined in Chapter 3 as the proposed system.

EXHIBIT 2

RELATIONSHIP & RESPONSIBILITIES OF PARTICIPATING AGENCIES

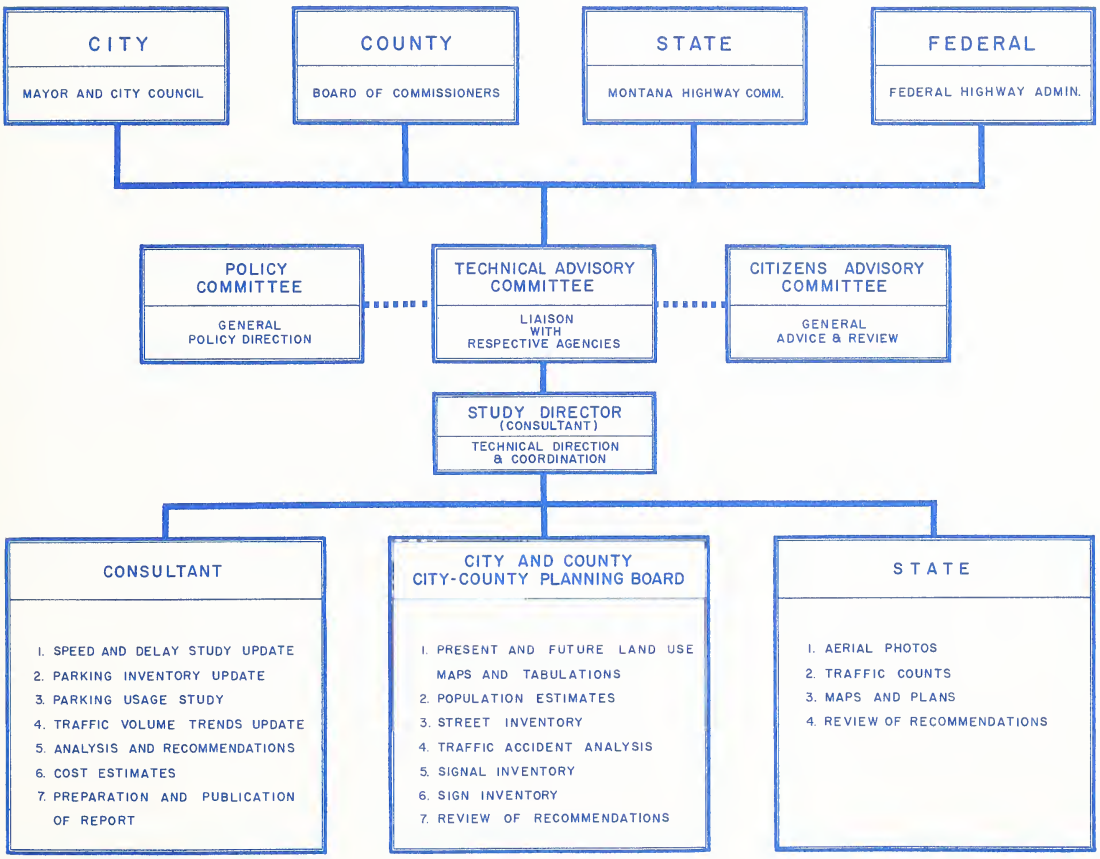
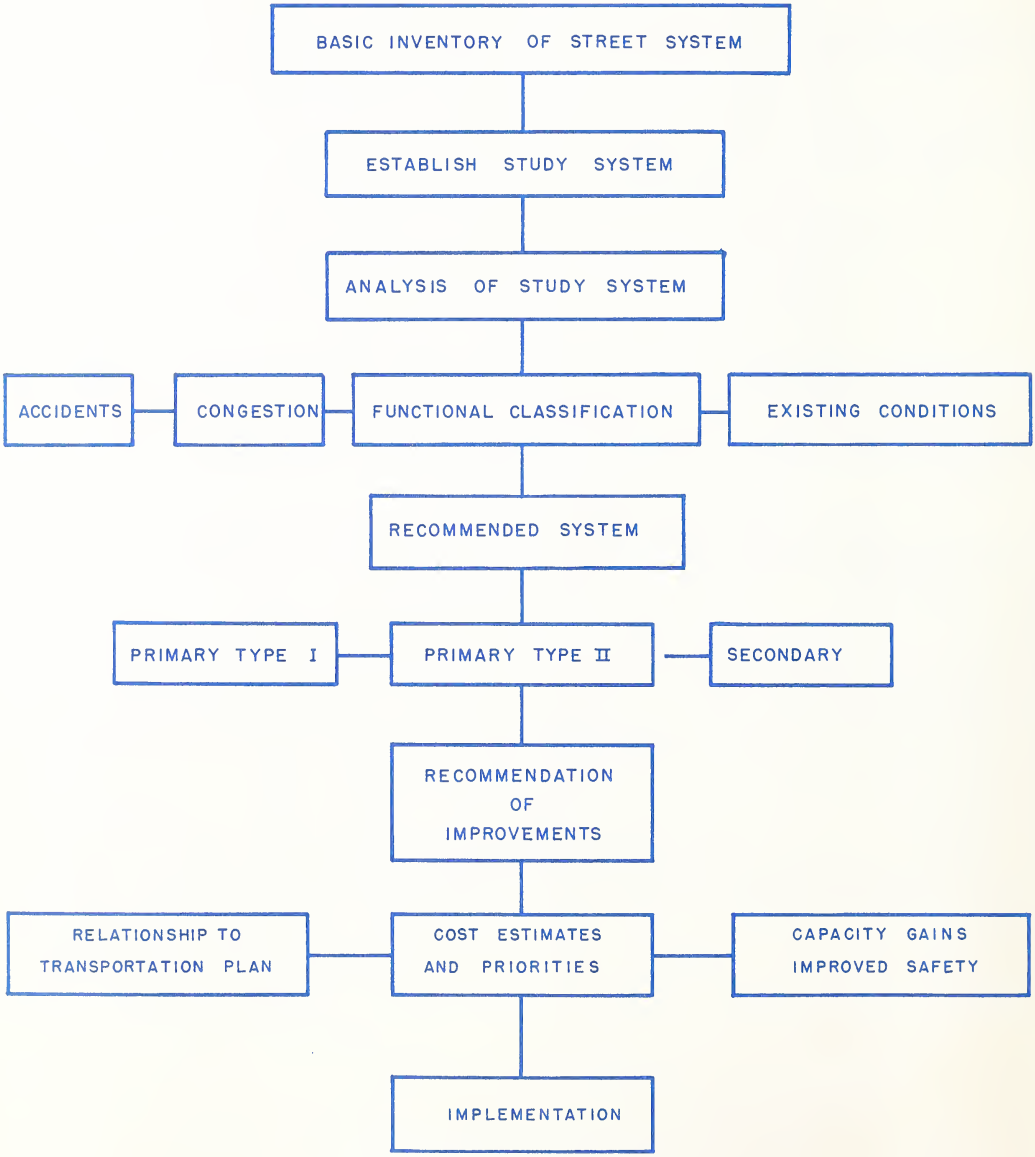


EXHIBIT 3

"TOPICS" STUDY APPROACH



STUDY AREA

INTERSTATE 15

NW BYPASS

CENTRAL AVE.

SMELTER AVE.

MISSOURI RIVER

6TH ST SW

AIRPORT

I-15

1ST ST

2ND ST

3RD ST

2ND AVE NO.

10TH AVE SO.

MALMSTROM AIR FORCE BASE

EXHIBIT 4

STUDY SYSTEM

LEGEND

PLANNING BOARD BOUNDARY

GREAT FALLS CITY LIMITS

STUDY AREA BOUNDARY

INTERSTATE HIGHWAY

PRIMARY TYPE I

PRIMARY TYPE II

SECONDARY

SCALE

0 2000' 4000' 6000' 8000'

1 MILE

N

FIELD SURVEYS:

A large amount of data was available from the recent Transportation Study Update for most of the streets contained in the "TOPICS" street study system. In most cases, data required updating only where specific changes had occurred between August 1968 and January 1970.

The major elements that were updated consisted of:

1. Turning movement counts at major intersections in the Central Business District.
2. Classification and volume counts at principal intersections along major arterial streets and in the Central Business District.
3. Speed and delay studies on major arterial streets.
4. Update of the parking inventory for both on-street and off-street facilities.
5. Parking usage study within the Central Business District.
6. Update of the signal inventory for the entire street system.
7. Street inventory, involving right-of-way widths and street widths, along with surface conditions and other data for those streets added as elements of the Primary Type II System.
8. Update traffic accident data for a three-year period through 1968.

CHAPTER 2

EXISTING TRAFFIC AND PARKING CONDITIONS

GENERAL:

This chapter describes the existing characteristics and usage of the Study Area street system, along with the related terminal facilities. The volumes and variation in traffic patterns are discussed and these patterns, when related to the characteristics and capabilities of the existing street network, help to identify the deficiencies and to delineate the major problem areas.

The major recent studies utilized in the preparation of the "TOPICS" Plan were:

1. The 1961 Great Falls Area Transportation Plan;
2. The 1968 Transportation Plan Update;
3. The 1968 Land Use Plan;
4. The 1968 Updated Socio-Economic Plan of the City-County Planning Board; and
5. The Functional Classification Study of the Montana Highway Department, Planning Survey Section.

A majority of the major street network is composed of a regular grid pattern. The grid pattern provides the structure of the Central Business District as well as a large portion of the remaining street system.

The major physical barrier within the Study Area is the Missouri River, extending from the southern boundary of the Study Area northward and eastward to the northeast corner of the Study Area. Another barrier is the Sun River, which enters the Study Area from the west and flows eastward to the Missouri River in the vicinity of the Warden Bridge. Other barriers to traffic include the railroad facilities of the Burlington-Northern Railroad Company and the Chicago, Milwaukee, St. Paul and Pacific Railroad Company. In some places these facilities also involve problems of capacity restraint and adverse safety considerations.

A major portion of the street network is situated in a relatively flat area involving minimum grade problems. In general, grades encountered on the entire street system vary from a minimum of zero percent grade to a limited number of streets having a maximum of approximately ten percent grades.

The Study Area contains a total of eight bridges, four major links across the Missouri River, and four bridges across the Sun River, two of which are major links in the network. The most

heavily used bridge is the Central Avenue West Bridge, with 1968 average daily traffic volumes of 19,700. The next most heavily traveled bridge is the Warden Bridge, crossing the Missouri River at 10th Avenue South and carrying 1968 average daily traffic volumes of 13,800. The other two bridges across the Missouri at 10th Street and 15th Street carry considerably less volume than the other bridges, but still are considered important links in the street network. For those bridges crossing the Sun River, by far the largest volume is carried by the 6th Street Southwest Bridge, which connects Interstate Spur I-315 to Central Avenue West. This bridge, along with the structure over the Sun River on Interstate I-15, carries approximately 87 percent of all traffic crossing the Sun River in West Great Falls.

STREET AND RIGHT-OF-WAY WIDTHS:

One of the basic objectives of "TOPICS" is to make maximum use of available streets; therefore inventories were made of all existing pavement and right-of-way widths for those streets included in the "TOPICS" Study System.

Great Falls is fortunate in that early planning of the community did provide adequate rights-of-way for a majority of the street system. For the most part, the major streets and thoroughfares have a minimum right-of-way width of 80 feet, while pavement widths vary from a standard 34-foot, curb-to-curb width for a majority of the system, up to 60-foot, curb-to-curb width on some of the major arterial streets. Some portions of the major street network, which are presently included on the Federal-Aid System, are considerably wider than this, with 100-foot or greater right-of-way widths, and in some cases from 70 to 80 feet of pavement width.

GENERAL LAND USE PATTERNS:

Land use patterns for Great Falls are shown in Exhibit 5, Page 15. In general, the present major land use areas and traffic generators of the community consist of:

1. The major business, cultural and financial center of the community is located in the Central Business District which is located between 2nd Avenue North and 2nd Avenue South from Park Drive to 9th Street.
2. A regional shopping center and secondary commercial area are located along 10th Avenue South, commencing at approximately 3rd Street and extending eastward to approximately 50th Street
3. An additional business area is located on Central Avenue West from approximately 3rd Street westward to 15th Street.

PLANNING JURISDICTIONAL AREA BOUNDARY

TRANSPORTATION STUDY AREA BOUNDARY

CITY LIMITS

1970 LAND USE

- SINGLE FAMILY RESIDENTIAL
- MULTI-FAMILY RESIDENTIAL
- MOBILE HOMES
- COMMERCIAL
- LIGHT INDUSTRIAL
- HEAVY INDUSTRIAL
- PARKS & RECREATION
- PUBLIC

N

SCALE IN FEET

0 500 1000 2000

4. The Anaconda Company Smelter, the major private employer, is located immediately north of the Missouri River at the alignment of approximately 21st Street to 34th Street.
5. Malmstrom Air Force Base is located at the eastern limits of the City.
6. Great Falls International Airport is located at the southwest limits of the City.
7. Heavy and light industrial areas are somewhat less defined than the business areas. However, the major industrial concentrations are located along the banks of the Missouri River from about 6th Street North downstream to about 25th Street.

The balance of the area is predominately residential, with multi-family residential areas adjoining the Central Business District and areas along 10th Avenue South. Public and semi-public lands are well apportioned throughout the community.

TRAFFIC VOLUMES:

Extensive traffic counts were taken on all segments of the street network during the recent Transportation Study Update. This information was coupled with supplemental information obtained in this study. By far the most heavily traveled section of the system is that on 10th Avenue South between 2nd and 25th Streets, where 1967-1968 average daily traffic volumes range up to 24,000 vehicles per day. August 1969 automatic recorder data showed a peak average weekday traffic volume of 26,797 vehicles per day on 10th Avenue South between 9th and 10th Streets. Many other sections of the system showed average daily traffic volumes in excess of 10,000 vehicles per day, as shown on Exhibit 6, Page 17.

Statistics from permanent counters indicate an average annual increase of approximately two percent per year in traffic volumes in Great Falls in the period 1967-1970.

TRAFFIC VARIATIONS:

Within the Great Falls area the Montana Highway Department maintains two permanent traffic counting stations which record traffic volumes by hours on a 24-hour, 7-day-a-week basis. These counters are located at 10th Avenue South and 9th Street and on 25th Street between 4th and 5th Avenues North. Information obtained from these counters provides statistics whereby daily, weekly and monthly variations can be determined. Both locations indicate peak traffic volumes in the months of July and August.

The traffic variations are shown graphically in Exhibits 7 and 8, Pages 18 and 19.

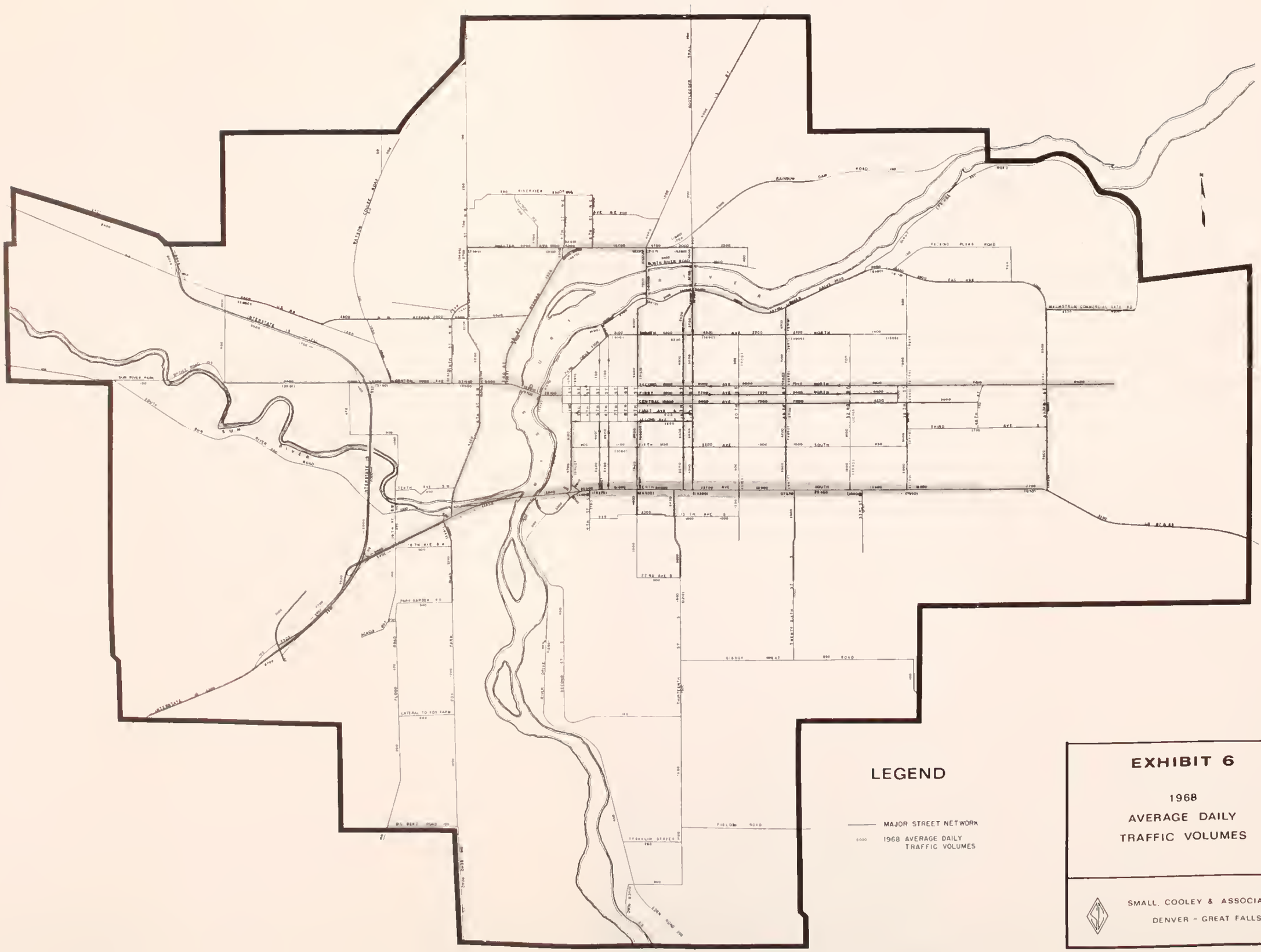

LEGEND
MAJOR STREET NETWORK
1968 AVERAGE DAILY TRAFFIC VOLUMES
EXHIBIT 6
1968
AVERAGE DAILY
TRAFFIC VOLUMES
SMALL, COOLEY & ASSOCIATES
DENVER - GREAT FALLS

EXHIBIT 7

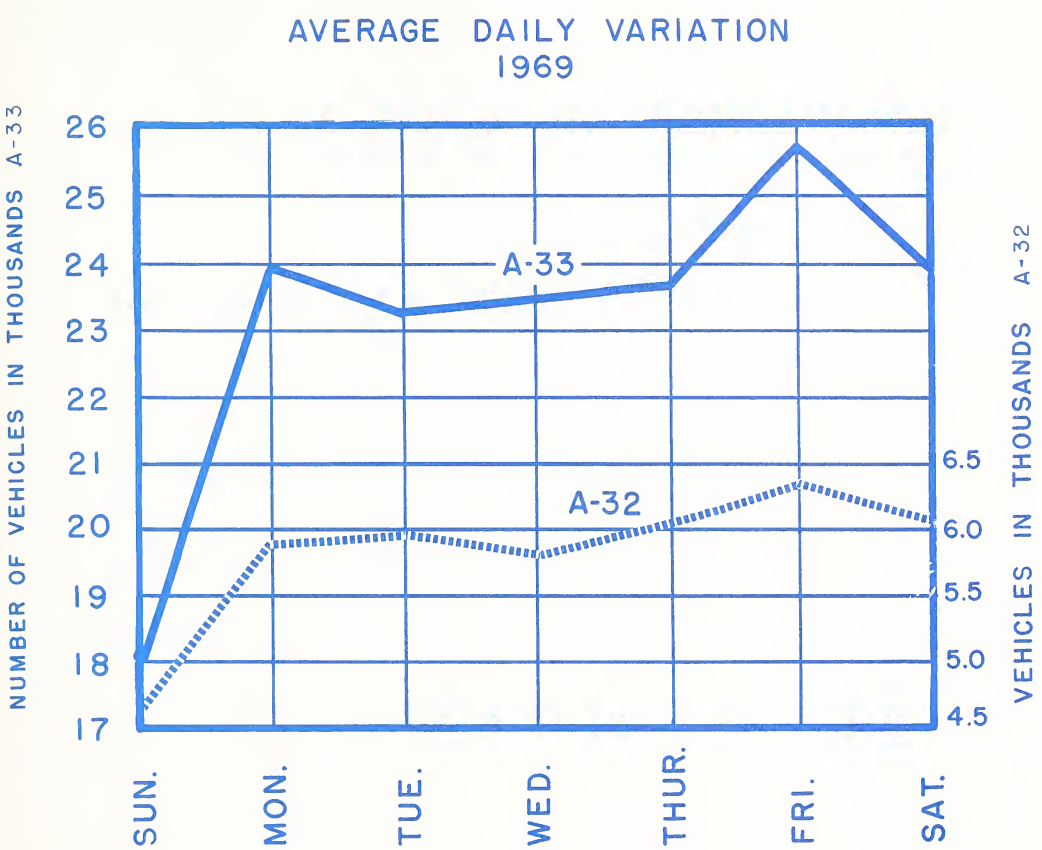
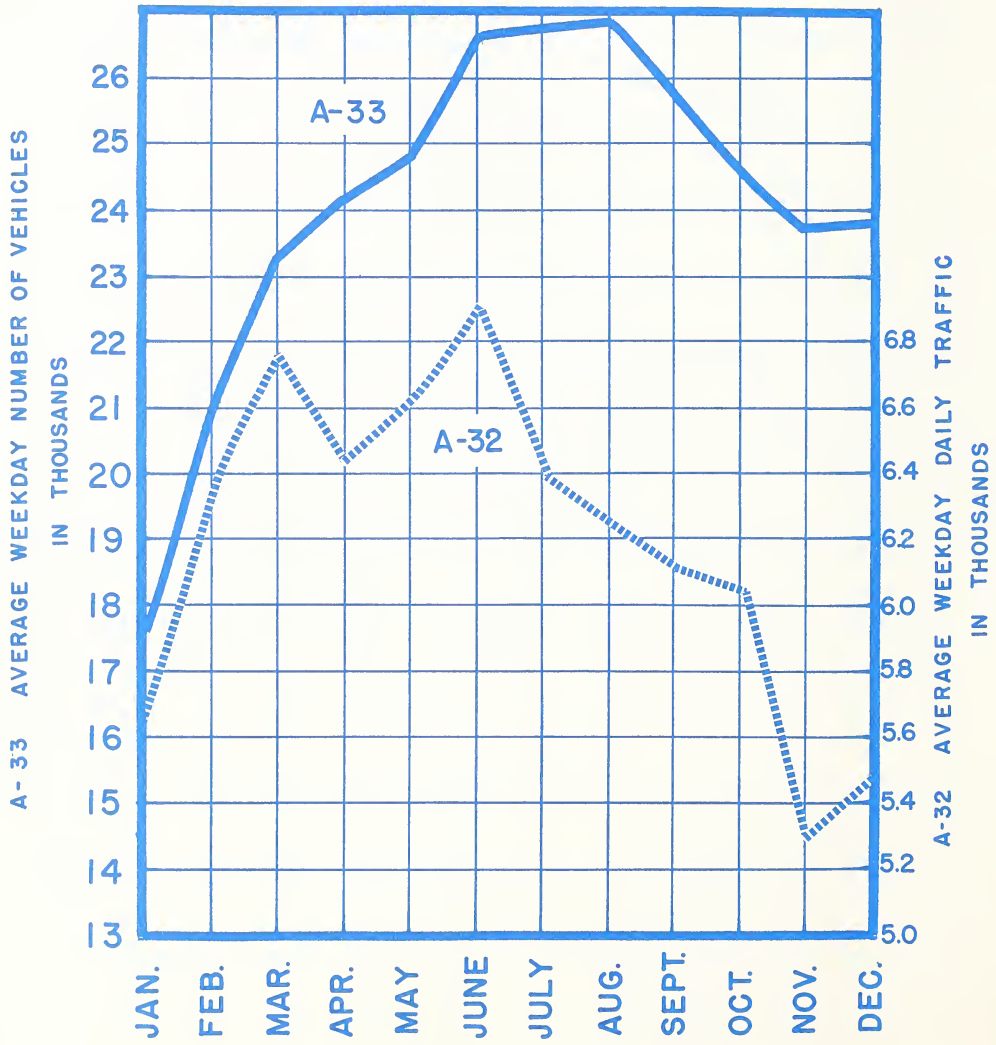

AVERAGE DAILY VARIATION
1969
NUMBER OF VEHICLES IN THOUSANDS A-33
VEHICLES IN THOUSANDS A-32
26
25
24
23
22
21
20
19
18
17
6.5
6.0
5.5
5.0
4.5
A-33
A-32
SUN.
MON.
TUE.
WED.
THUR.
FRI.
SAT.

EXHIBIT 8

AVERAGE WEEKDAY

MONTHLY VARIATION

1969



THE QUALITY OF TRAVEL:

Capacity calculations from the Transportation Study Update were utilized in Table 1, Page 21, which shows intersections operating at or near Level of Service "E" in 1970. The estimated 1970 Volume/Capacity ratio is also shown.

Another important item to be considered in the traffic operations plan is the ability of the street system to adequately handle the traffic volumes, particularly during the peak-hour periods. From speed and delay studies, the available speeds along the major routes within the Study Area have been determined for both peak-hour and off-peak-hour conditions. By comparing the time individuals use traveling from one area to another within the community, the peak and off-peak travel times and major points of congestion and delay can be determined. Throughout these studies, it became apparent that the major delays were experienced in the Central Business District on 1st Avenue North and 2nd Avenue North, Central Avenue and 1st and 2nd Avenues South. The same was true to a lesser degree on 10th Avenue South between 2nd and 25th Streets and on Central Avenue West between 3rd and 9th Streets. The results of the travel time studies on the major streets are shown in Exhibit 9, Page 22.

TRAFFIC ACCIDENTS:

All accidents occurring within the Study Area for the three-year period 1966, 1967 and 1968, were analyzed and tabulated as to type, severity and location. From this information it was possible to delineate and identify the major problem areas on the street system and to compare these statistics over a period of years to similar information obtained in previous studies.

For the three-year period from 1966 through 1968, the twenty locations where the highest number of accidents occurred are as shown in Table 2, Page 23. The number of accidents at each specific intersection is listed, along with a breakdown of accident type, property damage versus injury. During the same period, 1966 through 1968, locations with the highest number of accident occurrences as determined from accident studies are shown schematically on Exhibit 10, Page 24.

For the period from 1965 through 1968, the total number of accidents occurring on the major street network has remained fairly consistent at an average of approximately 1,786 per year. Fatalities for the same period of time have averaged 3.5 per year. However, the total number of accidents involving injuries has been consistently increasing from 207 in 1965 to 283 in 1968, as summarized in Table 3, Page 23.

TABLE NO. 1

INTERSECTIONS OPERATING AT OR NEAR LEVEL OF SERVICE E IN 1970

Intersection	Approach	Peak-Hour Approach Vol. (V)	Approach Capacity @ E	V/C
*1st Ave. N. & Park Dr.	South	611	912	.67
1st Ave. N. & 4th St.	West	1186	1610	.74
1st Ave. N. & 5th St.	West	1336	1676	.80
1st Ave. N. & 7th St.	West	1331	1822	.73
1st Ave. N. & 9th St.	West	1255	1585	.79
1st Ave. N. & 14th St.	West	1015	1225	.83
1st Ave. N. & 15th St.	West	994	1156	.86
1st Ave. N. & 25th St.	West	809	1025	.79
**Central Ave. & Park Dr.	South	507	580	.87
Central Ave. & 2nd St.	East	543	708	.77
Central Ave. & 5th St.	West	625	802	.78
Central Ave. & 25th St.	North	335	418	.80
1st Ave. S. & 2nd St.	South	427	456	.93
10th Ave. S. & 7th St.	West	1180	1340	.87
10th Ave. S. & 9th St.	West	1273	958	1.33
10th Ave. S. & 13th St.	South	500	660	.76
10th Ave. S. & 14th St.	West	1456	1680	.87
10th Ave. S. & 25th St.	North	265	275	.96
10th Ave. S. & 25th St.	East	1067	1020	1.05
10th Ave. S. & 25th St.	West	1335	1524	.88
***Central Ave. W. & 6th St. W.	East	828	790	1.05

* ** *** refer to turning movements which exceed capacity

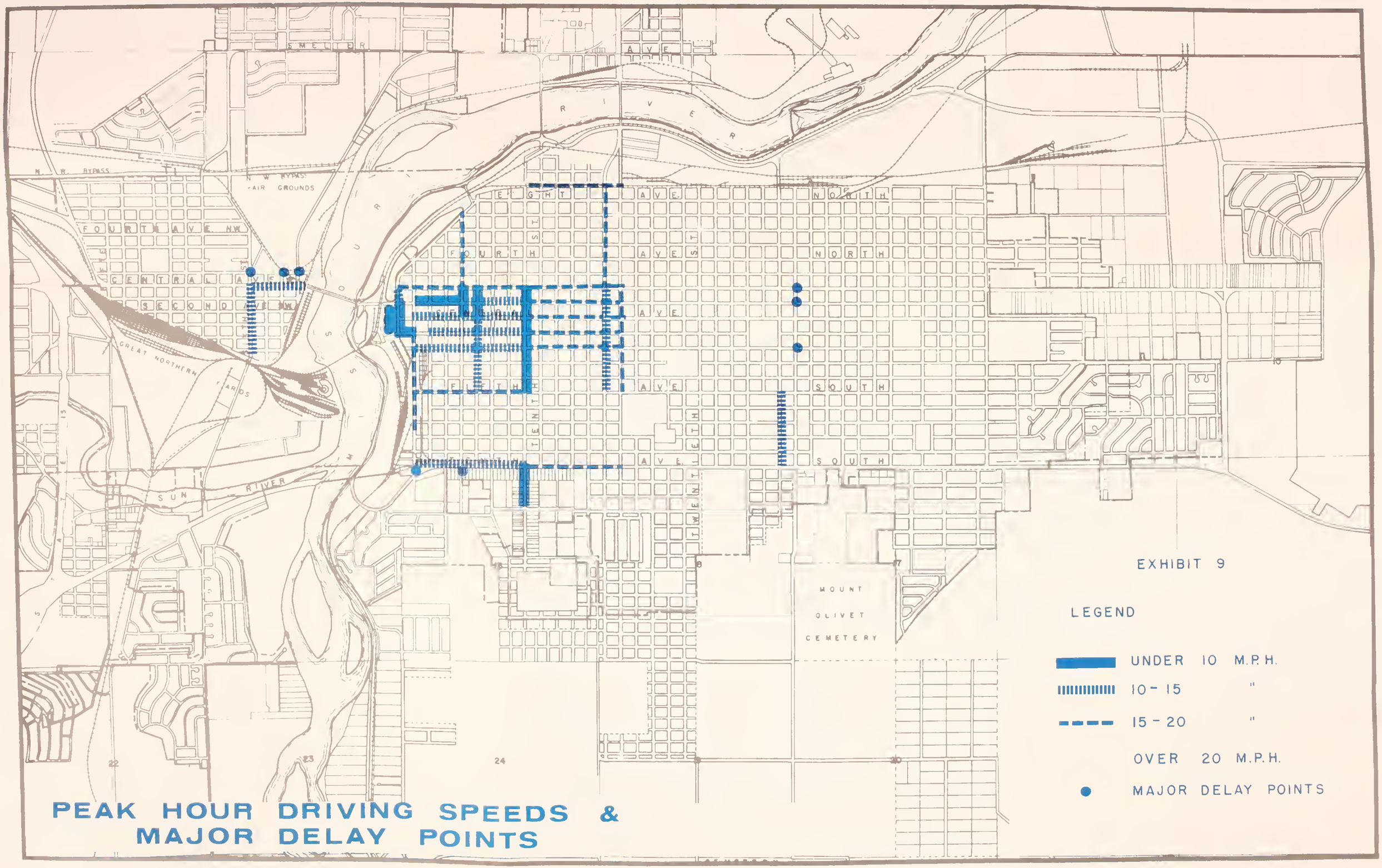

SMELTER DR
RIVER
AVE
N W BYPASS
FAIR GROUNDS
EIGHTH AVE NORTH
FOURTH AVE NW
FOURTH AVE NORTH
CENTRAL AVE NW
SECOND AVE NW
GREAT NORTHERN YARDS
FIFTH AVE
SOUTH
TENTH ST
ELEVENTH ST
SUN RIVER
MOUNT
OLIVET
CEMETERY
22
23
24
EXHIBIT 9
LEGEND
UNDER 10 M.P.H.
10 - 15 "
15 - 20 "
OVER 20 M.P.H.
MAJOR DELAY POINTS
PEAK HOUR DRIVING SPEEDS &
MAJOR DELAY POINTS

TABLE NO. 2

TOP TWENTY ACCIDENT INTERSECTIONS
FOR 1966, 1967, 1968

Location	1966 PDO	1966 Inj.	1967 PDO	1967 Inj.	1968 PDO	1968 Inj.	Total
10th Ave. S. & 9th St.*	18	3	21	4	20	5	71
10th Ave. S. & 14th St.	21	1	18	3	17	5	65
10th Ave. S. & 13th St.	18	3	15	7	18	4	65
Cent. Ave. W. & 3rd St.*	21	1	16	4	18	3	63
Cent. Ave. & 9th St.	9	6	14	5	22	3	59
Cent. Ave. & 2nd St.	13	2	19	1	20	4	59
Cent. Ave. & 3rd St.	19	1	19	1	14	1	55
1st Ave. N. & Riv. Dr.	10	8	11	5	15	4	53
10th Ave. S. & 25th St.	11	4	16	2	19	1	53
Cent. Ave. & 4th St.	20	1	17	2	11	1	52
Cent. Ave. & 5th St.	18	0	14	2	16	1	51
Cent. Ave. W. & 6th St.*	10	2	15	4	19	1	51
Cent. Ave. & 7th St.	17	0	16	3	13	2	51
Cent. Ave. & 15th St.	4	0	10	4	26	4	48
10th Ave. S. & 15th St.	7	2	15	4	14	5	47
2nd Ave. N. & 9th St.	10	*4	8	2	18	1	43
10th Ave. S. & 5th St.	11	3	12	1	12	2	41
10th Ave. S. (2nd or 3rd)*	13	1	12	2	10	2	40
1st Ave. N., Park Dr.*	14	1	3	3	14	4	39
Cent. Ave. & 14th St.	4	3	6	3	17	4	37

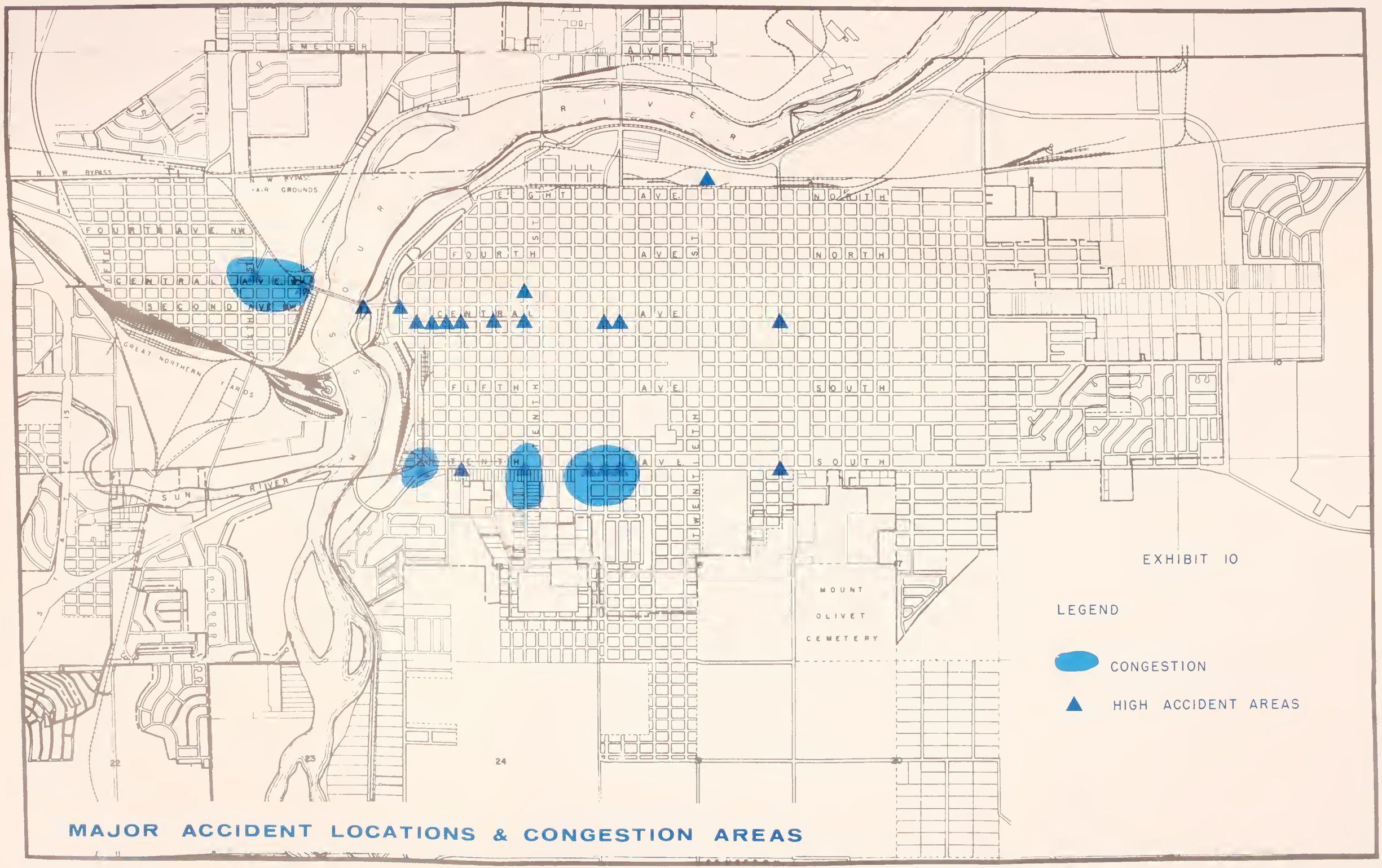
*Includes 1 fatality

PDO - Property Damage Only
Inj. - Accident Involving Injury

TABLE NO. 3

ACCIDENT STATISTICS FOR 1965-1968
(On Major Street Network)

	1965	1966	1967	1968	4-Year Average
Total Accidents	1,880	1,694	1,803	1,768	1,786.2
Fatalities	2	4	4	4	3.5
Accidents Involving Injury	207	225	245	283	247.3



MAJOR ACCIDENT LOCATIONS & CONGESTION AREAS

TRAFFIC SIGNALS:

There are 68 intersections within the Study Area that have some type of traffic signal control, as shown in Exhibit 11, Page 26, most of which are located in the Central Business District. Most of this equipment is twenty or more years old and requires replacement. (For signal inventory see Chapter 3, Page 32, 1968 Update.)

Some of the congestion in the Central Business District can be directly related to the lack of progressive timing of the traffic signals.

Many of the signalized intersections are below the minimum standards established in the Uniform Manual of Traffic Control Devices. In many cases, pedestrian movements are inadequately provided for and considerable upgrading of the entire system, including better pedestrian control, is considered a high priority item in the overall traffic operations plan.

SIGNING:

A detailed sign inventory was made by the City Engineer's Office. It was, however, apparent early in this inventory that most signing in the study area is substandard, except on Federal Highway Routes recently upgraded.

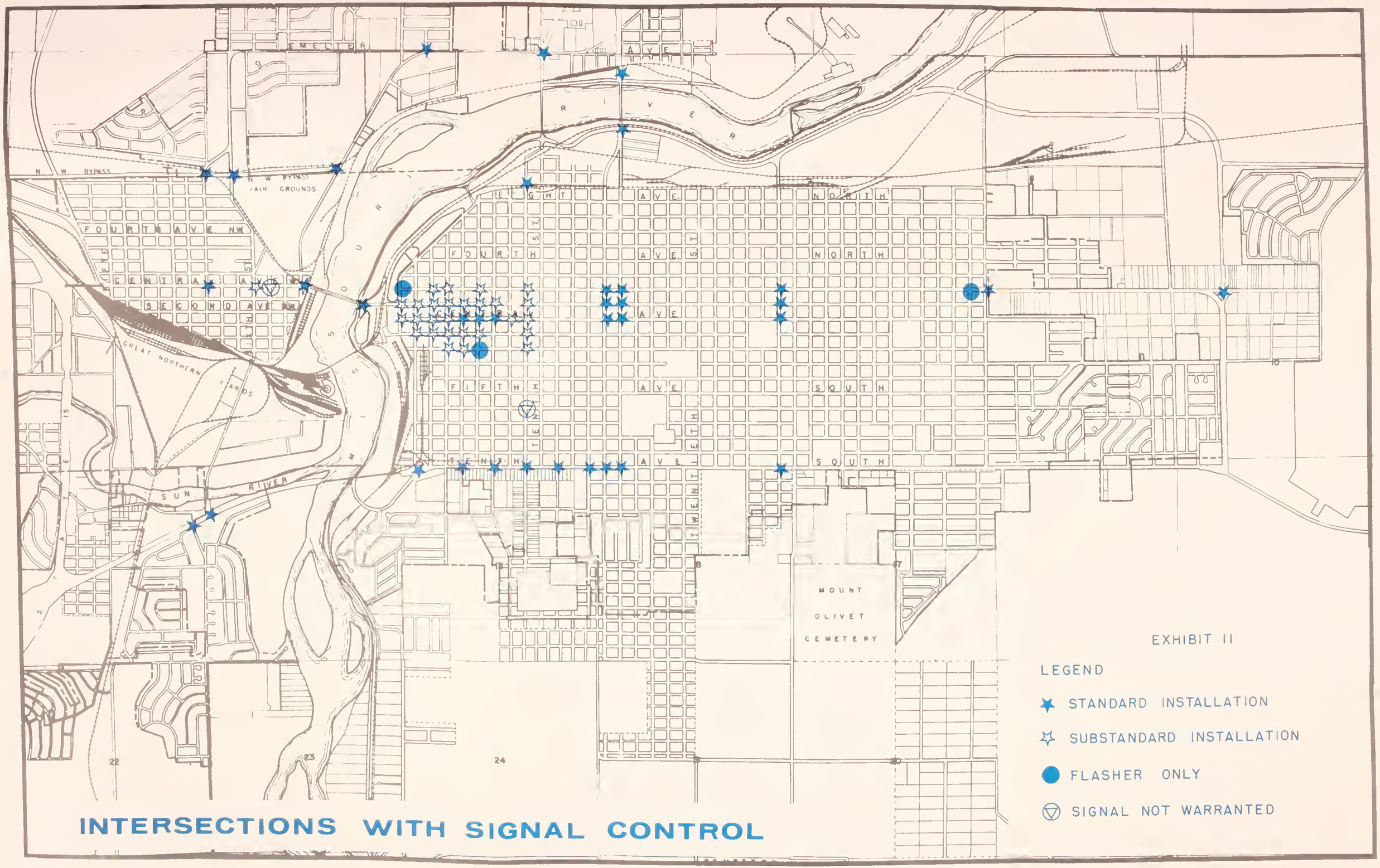
CURB PARKING INVENTORY:

All of the curb parking in the Central Business District is parallel. Metered parking at a rate of five cents per hour, with a two-hour maximum, is prevalent on most of the streets in the Central Business District. Fringe-area parking is unmetered, but is restricted to two hours maximum in most areas immediately adjacent to the Central Business District.

Of the 46,000 lineal feet of available curb space in the Central Business District, 60 percent is allotted to actual parking usage, whereas the remaining 40 percent is restricted parking for taxi zones, loading and unloading zones, end zones, fire hydrant locations, etc.

TRAFFIC LAWS AND ORDINANCES:

The City of Great Falls, until recently, was operating under a set of traffic laws and ordinances that were considered obsolete and in many cases in conflict with State and National laws. The traffic ordinances for the City had been last revised and updated in 1958, and in recent years the inadequacies of the existing laws had been of vital concern to local officials.



INTERSECTIONS WITH SIGNAL CONTROL

A complete revision of existing laws was undertaken in 1970. The Assistant City Attorney, in conjunction with the Great Falls City Police Traffic Department, thoroughly analyzed all existing ordinances with a view towards eliminating conflicts with State and National laws. The new ordinances are designed to work in conjunction with the laws of the State of Montana, and were as nearly as practicable patterned after the Model Traffic Ordinance, as contained in the Uniform Vehicle Code. They contain among other things a system of computerized accident data recording, which will enable local officials to keep close and constant surveillance of accident locations and causes, an operation which in the past has been very time consuming and costly. The revisions were accomplished early in 1971 and presented to the local governing bodies for their consideration. The new Traffic Ordinance was then put into effect in late summer of 1971.

MASS TRANSIT:

The feasibility of transit service in Great Falls, Montana, was the subject of a report published in June 1968 through a grant from the U. S. Department of Housing and Urban Development of the Mass Transportation Act of 1964.

The conclusions of that report indicated that public transportation was not essential to the well being of the community, but that such a community service would be a valuable catalyst in the community's continued growth and development.

There has been no public mass transportation system within the community since 1961, except for a one-bus operation provided by Malmstrom Air Force Base. While the community gets along well without it, there is a substantial measure of public inconvenience in the absence of this form of local transportation.

The feasibility study points out that were the community to implement a mass transit system utilizing gasoline or diesel-powered buses, an initial capital outlay of up to $115,000 would be required with the City being obligated for up to $94,000 of the capital cost. In addition, the report points out that a deficit in operation of the system in the range from $30,000 to $35,000 (including depreciation) could be expected.

The local governing body has appointed an Urban Transit Commission to study this matter, but to date no decision has been reached as to whether or not the City will pursue the recommendations of the transit report. In view of the costs involved and the fact that the community seems to be satisfied with complete

reliance on the private automobile, there is a real question as to the acceptability of a mass transit program. Consequently, the findings and recommendations of this report are based on the assumption that mass transit will not be implemented in the community.

AIRPORT ACCESS:

The City of Great Falls is presently engaged in a major planning program for relocating and upgrading the airport terminal facilities. If and when this is accomplished, additional airport access will be required. In the Transportation Plan Update of 1968 this new access has been recommended at approximately 27th Street Southwest, with a major portion of the airport traffic being routed via Central Avenue West to 27th Street Southwest, thence south across the Sun River and up Gore Hill to the proposed new terminal site.

It is not known at this time when such a project can be undertaken. However, it is apparent that new airport facilities will not be constructed for at least two years and during the interim present airport access by way of 10th Avenue South and Interstate 15 will be maintained. Present access is considered adequate for current conditions. Traffic time studies indicate that the average trip length from the Central Business District to the present terminal site is a little over ten minutes, which is not considered excessive. Until the new terminal facility is constructed, present airport access will be maintained and could adequately serve the needs of the community.

CHAPTER 3

SYSTEM CONSIDERATIONS

GENERAL:

After completion of the inventories of existing conditions of the major street system, and the identification of service deficiencies, a basis was formed for the development of a recommended "TOPICS" system for the Great Falls Study Area. Of major importance in the delineation of the "TOPICS" system were:

1. High accident areas;
2. Areas of congestion; and
3. Continuity of the street system as related to other Federal-Aid Systems.

MAJOR PROBLEM LOCATIONS:

On Exhibit 9, Page 22, and Exhibit 10, Page 24, are shown the major problem areas as determined from a combination of tabulations of accident studies (Table 2, Page 23), speed and delay studies, and volume-to-capacity analysis in the areas of maximum congestion.

In Table 1, Page 21, are listed the intersections within the Study Area that are approaching design capacity. When projected traffic volumes are assigned to the system, it can readily be seen that at these locations considerable improvement will be required to obtain an acceptable level of service. Operational deficiencies have been analyzed at all of the current deficient intersections or points of congestion. The list of intersections given in Table 1, Page 21, and Table 2, Page 23, point to the urgent need for improvement at these locations.

*THE RECOMMENDED SYSTEM:

In evaluating the existing Federal-Aid Systems within the Study Area, it is apparent that some updating of these systems is in order. The systems as now designed do not truly reflect the current situation in light of the many improvements that have been made over the years.

When considering the addition of a new Federal-Aid System, such as the Primary Type II, a necessary first step is the review of existing systems. The end result of all Federal-Aid Systems within the area should be logical and provide a means whereby the higher priority projects would receive the advantage of programing and construction under their respective designations.

*Note: A Federal Aid Urban System will be established at a later date.

The recommended system, as shown on Exhibit 12, Page 31 involves major changes in the current designations. These recommended changes, along with the reasons for each change, are as follows:

1. Northwest Bypass from its intersection with U. S. 87-91 to 3rd Street Northwest

This route is presently on the Secondary System. It is recommended that this portion of the street network be redesignated as Primary Type 1. This route as now constructed provides a direct connection between Interstate 15 and U. S. 87 North, and as such, provides a primary route through this portion of the Study Area.

Along with this change, it is further recommended that the portion of U. S. 87-91 from its junction with the Northwest Bypass east and south to Central Avenue West revert from Primary Type I designation as Primary Type II designation. These revisions are in keeping with the Policy and Procedure Memorandums for designation of Federal highway routes.

2. South River Road from 10th Street East and North to 2nd Avenue North via Northeast Bypass

This is presently on the Secondary System. The route as now established provides a direct connection from the main north-south primary route across the Study Area at 15th Street. It further provides a continuous loop around a major portion of the Study Area, connecting two major intra-state highways. As such, it is logical that this route revert from Secondary designation to Primary Type I designation.

3. 1st and 2nd Avenues North One-Way Couplet from 15th Street to 37th Street

When originally designated as a primary route some forty years ago, this served as the only logical east-west route across the Study Area. Improvements on 10th Avenue South, construction of Interstate 15 and the Warden Bridge have resulted in the primary east-west route changing to 10th Avenue South. As a result, 1st and 2nd Avenues North from 15th Street east no longer serve in the capacity of a primary highway and therefore should be removed from the Primary System and revert to Primary Type II designation.

Long-range programing indicates considerable construction has been recommended for widening and improving this route. However, in analyzing current and projected traffic volumes, it has been determined that these volumes could be adequately handled by restricting parking on one side of each street, thereby providing

STUDY AREA

INTERSTATE 15

NW BYPASS

CENTRAL AVE

SMELTER AVE.

MISSOURI RIVER

2ND AVE NO.

10TH AVE SO.

6TH ST SW

1ST ST

4TH ST

10TH ST

18TH ST

AIR PORT

MALMSTROM AIR FORCE BASE

I-15

EXHIBIT 12

RECOMMENDED SYSTEM

LEGEND

PLANNING BOARD BOUNDARY

GREAT FALLS CITY LIMITS

STUDY AREA BOUNDARY

PRIMARY I

SECONDARY

PRIMARY II

INTERSTATE

SCALE

0 2000' 4000' 6000' 8000'

1 MILE

N

considerable additional capacity without the necessity of major cost of reconstruction. This is particularly true of that section between 15th and 37th Streets. This portion was recently improved under Primary Type I funding and for the most part the surface conditions are considered adequate. It is recommended that those portions of 1st and 2nd Avenues North, west of 15th Street, remain on the Primary Type I System in that they do provide a direct connection to other primary routes both east and west and north and south.

4. Park Drive between 2nd Avenue North and 8th Avenue North

This portion of the street network is currently on the Primary Type I System, but really does not serve as a primary highway, but rather as a major collector for the local street system. It is therefore recommended that this segment of the network revert from Primary Type I to Primary Type II.

5. Smelter Avenue from 10th Street to the Anaconda Company Boundary

This portion of the network serves the Black Eagle area and at present does not have a Federal-Aid designation. After construction of the new 15th Street Bridge and the extension of 15th Street North, primary access to Black Eagle from Smelter Avenue was eliminated. Since Smelter Avenue provides a major connecting link from a substantial portion of the Study Area to major arterial roads, it is recommended that this route be designated as a Secondary stub route. This meets the criteria as established for Secondary routes by the Bureau of Public Roads.

6. Giant Springs Road from FAS-498 to Giant Springs

Giant Springs is considered as an important traffic generator and the road now existing serving this area is not on any Federal-Aid System. Planned development in the Giant Springs area indicates the need for improvements on this route. Here again, connecting links between traffic generators and other principal arterials justify adding this route to the Secondary System.

7. Fox Farm Road from 10th Avenue South to South Study Area Boundary

This route presently is not on the Federal-Aid System. Traffic volumes are increasing rapidly because of major new residential developments and with the advent of a major recreational and camping facility south of the community, as well as a major new Vo-Tech School, traffic volumes can be expected to substantially increase in the future. It is therefore recommended that Fox Farm be included on the Secondary System.

8. 4th and 5th Avenues South One-Way Couplet from 2nd and 3rd Streets to 43rd Street

These routes are recommended for addition to the Primary Type II System. These avenues, functioning as a one-way couplet, provide good continuity and were recommended in the 1961 Transportation Survey and again in the 1968 Update Study. This one-way couplet can function within the present right-of-way, including possible parking restrictions.

In addition to the above, it is recommended that the Federal-Aid System be enlarged to include the Type II Primary System, as shown on Exhibit 12, Page 31. In all, the final system as recommended includes under the various designation, 106 total miles allocated as shown in Table 4, Page 33.

TABLE NO. 4

MILEAGE SUMMARY - FEDERAL-AID SYSTEMS
GREAT FALLS "TOPICS" STUDY AREA

System Designation	Recommended System
Interstate	9 miles
Primary Type I	32
Primary Type II	50
Secondary	15
Total	106 miles

CHAPTER 4

TRAFFIC OPERATIONS IMPROVEMENTS

INITIAL IMPROVEMENT PROGRAM:

Since there was evidence of an immediate need for improvements in various areas of the community, it was decided to undertake an initial improvement program whereby immediate improvement could be realized, requiring minimum capital outlay and utilizing in most cases existing facilities in these critical areas.

At periodic technical committee meetings attended by representatives of the Planning Survey Section, Montana Highway Commission, the local Highway District Office, Bureau of Public Roads and the City of Great Falls and County of Cascade, suggested projects were submitted and discussed as to the nature of the recommended improvements and also as to priority. In addition, separate and sometimes joint meetings were held with the City Traffic Engineer, representatives of the local Police Department, and individuals of the State Highway Department, Maintenance Section and the State Traffic Engineer. In determining the projects to be submitted and considered herein as the Initial Improvement Program, consideration was given to:

1. Congestion

Particular attention was paid to those sections of the street network that were currently experiencing traffic volumes approaching or exceeding Level of Service "E." Level of Service "C" is therefore recommended to be the level of service to design to for "TOPICS" projects. The capacity calculations were made on individual lane usage as well as total approach capacity. Since the traffic volume counts used in this study were those obtained through the Transportation Study representing conditions in 1967, they were factored to represent 1970 conditions by applying the factor of 1.06. This factor was arrived at from the automatic recorders located within the community, indicating that approximately two percent-per-year increase in traffic was being experienced in recent years. This factor was compounded for the three-year period 1967 to 1970 and applied to the major traffic movements to give a more realistic idea of current conditions. This same factor has been applied to other principal traffic movements for succeeding projects in other areas of the community.

2. Accidents

High accident areas and intersections as noted in Tables 2 and 3, Page 23.

3. Efficiency and Safety

Areas and intersections where minor changes involving signal design, channelization, lighting improvements and other traffic engineering features that would effectively improve safety and convenience.

4. Long-Range Transportation Planning

Strong considerations were given to recommendations of the Transportation Plan for the Great Falls area and the Transportation Plan Update recently completed.

This initial improvement program consists of improvements in areas within the community, the total cost of which is estimated at $228,450. The projects are listed as follows in their suggested order of priority:

PROJECT NO. 1 (Area No. 1) Park Drive from Central Avenue to 2nd Avenue North. See Exhibit 15, Page 51.

Problem - Traffic congestion in this area has long been a matter of concern for State and local officials. This is particularly true at the intersections of Park Drive and Central Avenue and Park Drive and 1st Avenue North. The traffic signals at both intersections are far below minimum standards and do not provide adequate indications or control for vehicular or pedestrian traffic. The intersections operate on fixed cycles causing undue delay. North-bound left-turning vehicles at 1st Avenue North and Park Drive, and south-bound left-turning vehicles at Park Drive and Central Avenue have been observed being delayed through several signal cycles during evening and morning peak hours. These left-turn movements at both intersections cause considerable delay with a loss of capacity and efficiency.

Capacity - The critical left-turn movement at the intersection of Park Drive and 1st Avenue North during a peak hour from 4:15 to 5:15 p.m., in 1967, showed a total of 456 vehicles desiring to make the left turn.

The extremely high percentage (approximately 80 percent) of the northbound movement of left-turning vehicles at the intersection of 1st Avenue North and Park Drive is considered the prime factor for the congestion. When the 1967 left-turn movement of 456 vehicles per hour is factored to represent 1970 conditions, it shows 483 vehicles per hour desiring to make this movement. Under present conditions, a Level of Service "E" would accommodate somewhere in the range of 270 vehicles per hour, thereby indicating that this approach is operating well below Level of Service

"E." With the factored traffic volume data, the volume-to-capacity ratio for the left-turn movement is 1.79.

Much the same is true of the intersection of Central Avenue and Park Drive where the south approach to this intersection shows a factored 1970 approach volume of 568 vehicles. This amounts to a volume-to-capacity ratio of 1.25 for this approach.

Accidents - 1st Avenue North and Park Drive is one of the high accident locations on the Study System. During the three-year period 1966, 1967 and 1968, 39 accidents were experienced at this intersection. As indicated in Table 2, Page 23, this is the 19th highest accident intersection on the Study System. See Collision Diagram, Page 97.

Accidents are also a prime factor at the intersection of Central Avenue and Park Drive, with 34 accidents being reported for the three-year period from 1965 through 1967. This was the 20th highest accident intersection on the Study System for these years.

Recommendations - In order to improve the operating efficiency within the area and to improve safety, it is recommended that the improvements shown on Exhibit 15, Page 51, be considered the first priority project, consisting of the following:

Modify the right-turn bypass island on the northwest corner of Park Drive and 1st Avenue North so that the south edge of the island lines up with the north curb of 1st Avenue North, east of Park Drive.

Remove approximately 100 feet of the median island on 1st Avenue North, west of Park Drive, and replace with a double yellow centerline. This will allow the two westbound lanes to be widened by seven feet, facilitating an easier double left-turn from the south approach on Park Drive to the west.

Remove all remaining parking on the east side of Park Drive between Central Avenue and 1st Avenue North.

Restripe entire area along Park Drive between Central Avenue and 2nd Avenue North to provide for a double left-turn northbound on Park Drive at 1st Avenue North, and southbound at Park Drive at Central Avenue.

Install leading green phases at both intersections and rebuild existing signal to standard.

Evaluation - With these improvements, the "jammed" condition that exists at both intersections generally between the hours of

11:45 a.m. to 1:00 p.m. and 4:30 p.m. to 5:30 p.m. can be relieved and hopefully eliminated completely. Revisions should upgrade operating speeds in this area from two to nine miles per hour to twelve to fifteen miles per hour, increase overall capacity by 31.4%, and decrease overall accidents, especially the four right-angle and 25 rear-end type collisions.

PROJECTS NO. 2, 3 AND 11 (Area No. 2) Central Avenue West from 3rd Street to 9th Street

Central Avenue West serves as a major arterial connecting areas west of the Missouri River to the Central Business District and other points east of the Missouri River. Central Avenue West Bridge in 1967 had an ADT of 19,700, factored to 20,880 in 1970. In order to improve the operating conditions on this important arterial, a series of improvements has been recommended. These consist of channelization and signal improvements on 3rd Street, 6th Street and at 9th Street. In addition, a one-way couplet is being recommended for Railroad Avenue and 4th Street to provide better movement of traffic north and south across the lower southwest side.

PROJECT NO. 3 (Area No. 2) Central Avenue West and 3rd Street. See Exhibit 17, Page 53.

Problem - Recent improvements to 3rd Street Southwest and intersection revisions at Central Avenue West and 3rd Street have provided some improvement in traffic operations at this location. However, considerable inefficiency in traffic operations is still evident.

Under present conditions, the left-turn movement from east to south at the intersection of 3rd Street and Central Avenue West represents only six percent (64 vehicles per hour) of the total east approach peak-hour total of 1,121. Although this movement is not extremely heavy, it does create considerable problems for both the straight-through east-to-west movement, and the free east-to-north right-hand turn bypass. Because of limited storage in the westbound left-turn bay and in the straight-through bay, the free right-turn bypass from the east approach is operating ineffectively during the peak hour. More than one car in the left-turn bay and more than three cars in the straight-through lane totally close off the right-turn bypass movement with a resulting backup in traffic eastward to the railroad tracks and sometimes beyond. See Exhibit 17, Page 53.

Capacity - At present the east approach to this intersection is the most important. Peak hour volumes compared to capacity at Level of Service "E" result in a ratio of 0.83. However, the

backup problem resulting from very limited storage bays, as described under "Problem" is a major deficiency.

Accidents - This intersection ranks fourth, with 63 accidents reported for the three-year period 1966-1967-1968. Forty-two of these accidents (67%) were of the rear-end type, reflecting the extremely serious backup situation previously mentioned.

Recommended Improvements - Analysis of the area indicated that considerable improvement could be realized by eliminating the left-turn movement for westbound traffic on Central Avenue West at 3rd Street and providing for such turns one block further west at 4th Street where there is room to provide an adequate left-turn bay. By providing a one-way couplet, utilizing existing facilities on Railroad Avenue, 3rd and 4th Streets with southbound traffic being diverted to 4th Street and northbound traffic utilizing Railroad Avenue and 3rd Street Northwest, considerable relief could be obtained at other points along Central Avenue West. By eliminating the left-turn movement at 3rd Street from east to south, the capacity of this intersection could be greatly improved for the heavy straight-through movement from east to west.

Evaluation - These proposed improvements could increase westbound capacity 57 percent and eastbound capacity 26 percent. In addition, the heavy left-turn movement from the north, with a factored peak-hour volume of 233 vehicles, would also be greatly improved by elimination of the left-turn movement from the west and providing more room at the east approach for the double left-turns from the north to enter Central Avenue West. At the present time, southbound to east double left-turns are restricted to minimal ten-foot lane widths on Central Avenue West. By increasing these to approximately thirteen-foot lanes, the north approach left-turn movements would be able to move much more safely and conveniently.

A significant decrease in accidents at this intersection should result from these improvements, particularly in the 42 rear-end accidents.

The peak hour driving speed of 10-15 m.p.h. and designation of this section as a "major delay point" (see Exhibit 9, Page 22) will both be significantly improved.

It should be noted that the Phase B movement at this intersection combines southbound turning movements with the northbound straight-through traffic. This same situation exists today. Northbound traffic going straight through the intersections only totals 90 vehicles per hour in 1970. It is believed that these movements can successfully share this signal phase for the foreseeable future. If volumes do increase to the point that

conflicts arise, the southbound double left-turn can be given a leading-green phase. This will, however, take green time from the Phase A movement westbound and should be avoided as long as possible.

PROJECT NO. 2 (Area No. 2) Central Avenue West and 6th Street. See Exhibit 16, Page 52.

Problem - The present signal installation is far below standard and does not provide adequate indications or control for vehicular or pedestrian traffic. The intersection operates on a fixed cycle causing undue delay. All left-turn movements must be made from through lanes, also causing considerable delay and loss of overall capacity to through traffic.

Capacity - The present capacity calculated at the east, or most critical approach, indicates that the peak-hour volumes are creating a volume-to-capacity ratio of 1.05. The inability of vehicles desiring to make the left turn from this approach is considered to be the principal factor involved in this major deficiency.

Accidents - The intersection ranks twelfth in accidents, with 51 accidents recorded for the three-year period, 1966-1968. An analysis of the accidents indicates that at least 20 of the 51 recorded accidents are of the type that could be eliminated with proper channelization and updated signals.

Recommended Improvements - Since adequate warrants for signalization exist, volumes and accidents, it is proposed to rebuild the signal installation to standard mast arm design providing for the leading green phase as shown by Exhibit 16, Page 52. The approaches on 6th Street are to be actuated, providing a more continuous movement on Central Avenue West and interrupting this flow only on demand from the side street or pedestrian actuation.

Removal of parking at all approaches is necessary in order to gain the necessary width for the left-turn bays. It will also be necessary to widen the south approach between 1st Avenue South and Central Avenue West to a minimum of fifty feet. This can be accomplished within the existing right-of-way.

Evaluation - These improvements will increase the overall capacity an estimated 70 to 80 percent on Central Avenue West and 30 to 40 percent on 6th Street. This is primarily due to the addition of left-turn storage bays for all approaches and actuation of the cross street movement. The capacity of the east approach should increase from 790 vph to 1,470 vph, approximately 86 percent.

A decrease in the number of turning movement, angle and rear-end type collisions should also be noted.

PROJECT NO. 11 (Area No. 2) Central Avenue West and 9th Street. Exhibit No. 25, Page 61.

Problem - The present signal has recently been brought up to minimum standards as related to vehicular indications. This intersection does not provide adequate control for pedestrians. This intersection also is operating on a fixed cycle causing undue delay. In addition, all left-turn movements at this intersection must be made from through lanes, causing considerable delay and loss of overall capacity to through traffic lanes.

Capacity - The calculated capacity of the east approach at this intersection is 1,156 vehicles per hour. Factored 1970 volumes at this approach show 579 vehicles per hour. As at the intersection of Central Avenue West and 6th Street, the inability of vehicles desiring to make the left turn from this approach is considered to be the principal deficiency. Anytime a through lane is used for left-turning vehicles, delay and loss in capacity is experienced with an increase in certain types of accidents.

Accidents - This intersection is not listed on the top 20 high accident locations. It ranked 36th for the period 1965-67, with 24 accidents. It ranked 10th in the period 1960-62, but the improvements have caused this high ranking to drop from 10th to 36th.

Recommended Improvements - Since adequate warrants also exist at this intersection, it is proposed that pedestrian indications with proper clearances be added as shown on Exhibit 25, Page 61, Both approaches on 9th Street should be actuated to reduce the overall delay to traffic on Central Avenue West. This signal is to be timed in and programmed with other signals along Central Avenue West.

Removal of parking at the intersection as needed is recommended to provide for left-turn storage bays for all approaches.

Evaluation - These improvements will increase the overall capacity at this intersection by an estimated 70 to 80 percent on Central Avenue West and 30 to 40 percent on 9th Street. This is primarily due to the addition of left-turn storage bays for all approaches and actuation of the cross street pedestrian and vehicular traffic.

The improved signal design and channelization should greatly assist the motorist and pedestrian and reduce overall accidents, especially right angle, turning and rear-end types.

PROJECT NO. 4 (Area No. 3) Smelter Avenue and Division Road. Exhibit No. 18, Page 54.

Problem - The City has recently extended Division Road south of Smelter Avenue to connect with the new 3rd Street Southwest project recently completed by the State Highway Department. Although traffic volumes on this link are not high at this time, they are expected to increase rapidly as soon as the Riverview area residents become accustomed to this new route. In addition, plans are now underway to construct new access to the C. M. Russell High School, which will connect to Division Road about 1,200 feet south of Smelter Avenue. It is expected that this connection alone will attract high volumes of traffic for those areas lying north of Smelter Avenue and will become a prime access route to the C. M. Russell High School. As such, traffic volumes can be expected to increase, both on Division Road and Smelter Avenue.

Capacity - Traffic volumes have shown continual increase over the past several years on Smelter Avenue. Average daily traffic volumes on Smelter Avenue increased from 5,125 in 1961 to 7,314 in 1970. Rapid buildup on the residential areas in Riverview, coupled with the construction of the C. M. Russell High School, Westgate Shopping Center and other commercial construction are responsible. On the east approach, the peak hour approach volume in 1970 is 843 vehicles. The calculated capacity is 1,020 vehicles, for a V/C ratio of 0.83.

Accidents - Because both roadways have been opened recently, no accident history is available. However, it is believed that a serious accident potential exists at this intersection because of lack of lighting, channelization, pavement markings and signalization.

Recommendations - Although existing traffic volumes alone may not warrant immediate signal installation at either this intersection or at 4th Street Northeast and Smelter Avenue, they are being recommended on a combination of warrants, including safety considerations. See Federal Highway Administration P.P.M. 21-18 dated May 28, 1970, Page 3 (7d). Specifically, the improvements will divert traffic from other congested areas to this more direct route when this intersection is made safer, more free of congestion and more attractive to the public. An additional warrant is to promote the safety and uninterrupted flow of vehicular and pedestrian traffic associated with the High School.

The major items considered under this improvement will be the installation of a new standard signal design, actuating the Division Road approaches to Smelter Avenue, provide the necessary signing and striping to conform with design and provide intersection lighting.

Evaluation - With these improvements, which include proper intersection lighting, actuated signals, signing and pavement markings, traffic volumes are expected to increase rapidly. Motorists will be attracted to this route. Installation of the signal may be deferred for a short time, but initial improvements should provide for the signal installation. Vehicular and pedestrian safety will be enhanced by these improvements. Traffic capacity would be increased by an estimated 30 percent, and delays reduced.

PROJECT NO. 5 (Area No. 3) Smelter Avenue and 4th Street N.E. Exhibit No. 19, Page 55.

Problem - The poor alignment and lack of channelization and signalization, along with improper lighting, result in very dangerous and inefficient operation at the intersection of 4th Street Northeast and Smelter Avenue. There exists a 72-foot jog in 4th Street Northeast across Smelter Avenue that requires north-south traffic to make a weaving motion through the intersection.

Capacity - Traffic volumes have shown continual increase over the past several years on Smelter Avenue. Average daily traffic on Smelter Avenue increased from 5,125 in 1961 to 7,314 in 1970. Rapid buildup on the residential areas in Riverview, coupled with the construction of the C. M. Russell High School, Westgate Shopping Center and other commercial construction are responsible. On the west approach the peak hour approach volume in 1970 is 803 vehicles. The calculated capacity is 1,123 vehicles, for a V/C ratio of 0.72.

Accidents - Only recent accident experience is available, because of the recent construction at this intersection. In 1969 one accident was recorded, in 1970 three accidents, and in 1971 (January 1 - July 15) seven accidents were recorded to date. Four of the eleven accidents involved turning vehicles, and one right-angle collision was recorded.

Recommendations - At 4th Street Northeast and Smelter Avenue, it is recommended that a transition be constructed across Smelter Avenue, providing for improved alignment of 4th Street Northeast. This will require some minimal right-of-way acquisition and some construction for curb and gutter and street construction work on the northwest and southeast corners. It is further recommended that channelization and restriping of Smelter Avenue be provided with the end result to be for two through lanes with separate turn bays. Installation of a standard signal design is recommended, actuating 4th Street Northeast approaches and providing the necessary signing to conform with design. Street lights should be added, the installation of which will be combined with the traffic signal installations.

Although existing traffic volumes alone may not warrant immediate signal installation at either this intersection or at Division and Smelter, they are being recommended on a combination of warrants, including safety considerations. See Federal Highway Administration P.P.M. 21-18 dated May 28, 1970, Page 3 (7d). Specifically the improvements will divert traffic from other congested areas to this more direct route when this intersection is made safer, more free of congestion and more attractive to the public. An additional warrant is to promote the safety and uninterrupted flow of vehicular and pedestrian traffic associated with the High School.

Evaluation - With these improvements, which include proper intersection lighting, actuated signals, signing and pavement markings, traffic volumes are expected to increase rapidly. Motorists will be attracted to this route. Installation of the signal may be deferred for a short time, but initial improvements should provide for the signal installation. Vehicular and pedestrian safety will be enhanced by these improvements. Traffic capacity would be increased by an estimated 30 percent, and delays reduced.

PROJECT NO. 7 (Area No. 4) 10th Avenue South and 2nd Street. Exhibit No. 21, Page 57.

Problem - In this area, congestion and inefficiency of operation have been noted for an extended period of time. The most serious problem at 2nd Street and 10th Avenue South involves the north approach to the intersection. Eighty-five percent of the vehicles entering from the north are making the left-turn movement from north to east. Because of inefficient operation, considerable congestion is evident with cars backing up from 400 to 500 feet on the north approach, unable to make the left turn because of the exceedingly heavy straight-through volumes on 10th Avenue South. Although this approach is actuated, the green time allowed for the left-turn movement is not considered adequate, with only one lane being provided for this movement.

Capacity - The peak-hour approach volume from the north has been calculated to be 218 vehicles per hour, with 185 of those vehicles desiring to make the left-turn movement. The present capacity of the left-turn lane at Level of Service "E" is 143, giving a V/C ratio of 1.3. This is one of the most heavily travelled intersections on the Study System. Traffic congestion and heavy delay during the peak hours is evident on almost every weekday throughout the entire year. See Exhibit 9, Page 22.

By redesigning the 2nd Street approach, adding an additional lane for the left-turn movement, along with the necessary signal revisions, channelization and striping, the capacity of this

approach would be more than doubled and could immediately relieve the congestion now so evident.

Accidents - This intersection is 18th on the top 20 accident intersections for 1966-68. There were 40 accidents reported during this period. Seventeen of these accidents are of the type that proper signalization would significantly reduce. See Table 2, Page 23.

Recommended Improvements - This intersection should be revised as recommended in the 1968 Transportation Study Update. Signal revision is recommended, along with approach redesign, widening and channelization. Some new right-of-way will be required for the new north approach. Do not include the connection to the 2nd and 3rd Street one-way couplet at this time, as it will be included at the time these streets are converted to one-way operation. Interim connection will be made to 2nd Street. To be included will be the provision of a merging lane at the intersection east to 4th Street on the south side of 10th Avenue South, relocation of the approach from 2nd Street to 10th Avenue South, rechannelization of the intersection and complete rebuilding of the traffic signal. Street light poles and traffic signal poles are to be combined.

Evaluation - With these improvements, the overall capacity at this intersection will increase about 71 percent. New capacity for southbound left-turning vehicles will be more than doubled. Accidents at this intersection would be significantly reduced -- particularly the rear-end and right-angle types. The severe delays at the north approach would also be significantly reduced.

The ultimate solution that has been recommended at 2nd Street and 10th Avenue South under the Transportation Plan is to provide a grade separation, with the construction of a modified diamond-type interchange. This solution has been tied with the construction of additional two lanes on Warden Bridge, and as such, is considered a relatively long-range type program.

PROJECT NO. 8 (Area No. 4) 10th Avenue South and 9th Street. See Exhibit 22, Page 58.

Problem - The south approach to the intersection of 9th Street and 10th Avenue South is experiencing rapid traffic buildup due to continued traffic being generated by the Holiday Village. Recent additions to the Holiday Village shopping complex have resulted in a larger proportion of the traffic being channeled to 9th Street, resulting in extended periods of delay and congestion from the south approach.

Capacity - 10th Avenue South at 9th Street today has average daily traffic volumes estimated to be in excess of 24,000 vehicles,

with a peak-hour volume for the east-west movement on the order of 2,200 vehicles per hour.

By factoring 1967 data to reflect 1970 conditions, a minimum of 242 vehicles per hour will enter from the south approach.

The calculated capacity at Level of Service "E" for the west approach is 958. The 1970 volumes for this approach are 1,273 vehicles, resulting in a V/C ratio of 1.33.

Accidents - This intersection is No. 1 on the top 20 accident intersections for 1966-68, with a total of 71 accidents reported. Twelve of these included injury. Twenty-five percent to thirty-five percent of these accidents could be attributed to inefficient signal operation or poor observance.

Recommended Improvements - The south approach should be widened for a distance of approximately 300 feet to provide a total 50-foot section. This requires some parking restriction in the area. The south approach should be restriped to provide for two through lanes and a separate left-turn bay and a right-turn lane. Rebuild existing substandard actuated signal to standard design and combine street lighting with signal pole installations.

Evaluation - These improvements will increase the capacity of the south approach by 148 percent (250 vehicles per hour to 620 vehicles per hour). In addition, the right-angle and rear-end type accidents will be greatly reduced.

It should be noted that the recommended improvements for 10th Avenue South in this area as shown on Exhibit 27, Page 71, are the more long-range recommendations for further upgrading of the traffic flow on 10th Avenue South.

PROJECTS 6, 9 AND 10 (Area No. 5) North River Road Facility from 10th Street Eastward to the Newly Constructed Northeast Bypass in Vicinity of Giant Springs Intersection. See Exhibits 20, 23 and 24, Pages 56, 59 and 60.

This facility as presently constructed is considered deficient to handle current traffic volumes and with increasing traffic volumes being evident, immediate improvement along the route is deemed necessary in the interests of safety, access and convenience. The route contains three major intersections, 10th Street, 15th Street and 25th Street. At the present time, only the 15th Street intersection is signalized.

The lighting of the roadway is far below I.E.S. minimum standards with no lighting at all in some areas. Guard rail and delineation along the north side of the road has been allowed to

deteriorate to a point where no protection is afforded. This includes the center line striping which should carry the no-passing double-yellow for the entire length of the roadway in this critical area.

The very poor alignment, coupled with improper lighting and restricted widths in some areas, result in hazardous driving conditions, particularly during the hours of darkness.

PROJECT NO. 10 (Area No. 5) River Road, 9th Street to Giant Springs Road. See Exhibit 24, Page 60.

Problem - As outlined above under opening statement.

Capacity - 1970 average daily traffic volumes are in the order of 7,870 vehicles per day in the section between 15th and 25th Streets and on the order of 3,590 vehicles per day on the section between 10th and 15th Streets. The V/C ratio at intersection approaches on River Road is 0.72 at the higher volumes. On this type of single-lane facility, these volumes indicate a problem if not properly controlled. This includes providing proper access. Today only one out of three access points are properly controlled. This road functions as a bypass route and as a road to a recreation area.

Accidents - During a three-year period between 1966 and 1968, there were 96 accidents reported on the section of River Drive from 10th Street to the Giant Springs intersection. From analysis of the accident statistics, 31 of these accidents could have substantially been reduced in severity or prevented altogether if the roadway had been properly lighted, painted and delineated, along with guard rail protection on the outside shoulder. The right-angle, rear-end and single-car accidents will increase over the next few years unless traffic is properly controlled through signalization, lighting, channelization, and pavement markings. In addition, the safety considerations are such that immediate improvement of the guard rail, particularly along the north edge, be upgraded to prevent more serious accidents.

Recommended Improvements - Provide at least minimum lighting (400-foot spacing) along the entire section of River Road from 10th Street to the intersection of Giant Springs Road, except at major intersections where intensity should be increased.

Provide guard rail where necessary, as shown on Exhibit 24, Page 60, and restripe from 10th Street to the Giant Springs intersection.

Evaluation - These improvements will increase the overall capacity and safety along this roadway by 60 to 70 percent, in

addition to providing added capacity and safety to the two additional access points of 10th and 25th Streets.

PROJECT NO. 9 (Area No. 5) River Road and 25th Street. See Exhibit 23, Page 59.

Problem - 25th Street is a major north-south feeder street between River Road and 10th Avenue South. This intersection has three major points of conflict, each of which are uncontrolled and improperly lighted, causing confusion, delay and congestion. Also note the Area No. 5 opening statement about River Road.

Capacity - Present-day capacity at this intersection is far below capacity capabilities of both River Road and 25th Street. This deficiency is due to improper channelization, lighting and signalization. 1970 average daily traffic volumes are in the order of 7,870 vehicles per day in the section between 15th and 25th Streets. The V/C ratio at intersection approaches on River Road is 0.72 at the higher volumes. On this type of single-lane facility, these volumes indicate a problem if not properly controlled. This includes providing proper access. Today only one out of three access points are properly controlled.

Accidents - Along River Road between 10th Street and Giant Springs Road for the three-year period of 1966-68, there were 96 accidents recorded. Of these 13 involved injury, 34 were night-time, and 31 involved guard-rail or delineation deficiencies. Most of these accidents are due to insufficient night-time lighting and improper channelization or delineation and lack of proper traffic control. Fourteen of these accidents were at the intersection of 25th Street and River Road. Most of these were of the types that the recommended improvements would correct.

Recommended Improvements - Repave the intersection and shoulders as needed to provide for combination concrete (pin-down) and paint channelization, eliminating two of the three points of conflict. Install a standard mast-arm traffic signal actuating the 25th Street approach. Traffic signal and street light poles should be combined and set back from shoulders of roadway at least ten feet wherever possible. However, in many cases this may not be practical because of the steep slope. This work is to be coordinated with the overall River Road lighting, striping, and guard-rail and delineation project. These improvements are being recommended primarily from the standpoint of safety considerations.

Evaluation - These improvements will increase the overall capacity and safety at this intersection by an estimated 30 percent. With the completion of the improvements along River Road outlined under project #10, and at the intersection of River Road and 10th Street (project #6), the traffic volumes along River

Road will increase an estimated 60 percent in capacity. This increase is due to proper signalization, pavement markings, signing, lighting and delineation.

PROJECT NO. 6 (Area No. 5) River Road and 10th Street. See Exhibit No. 20, Page 56.

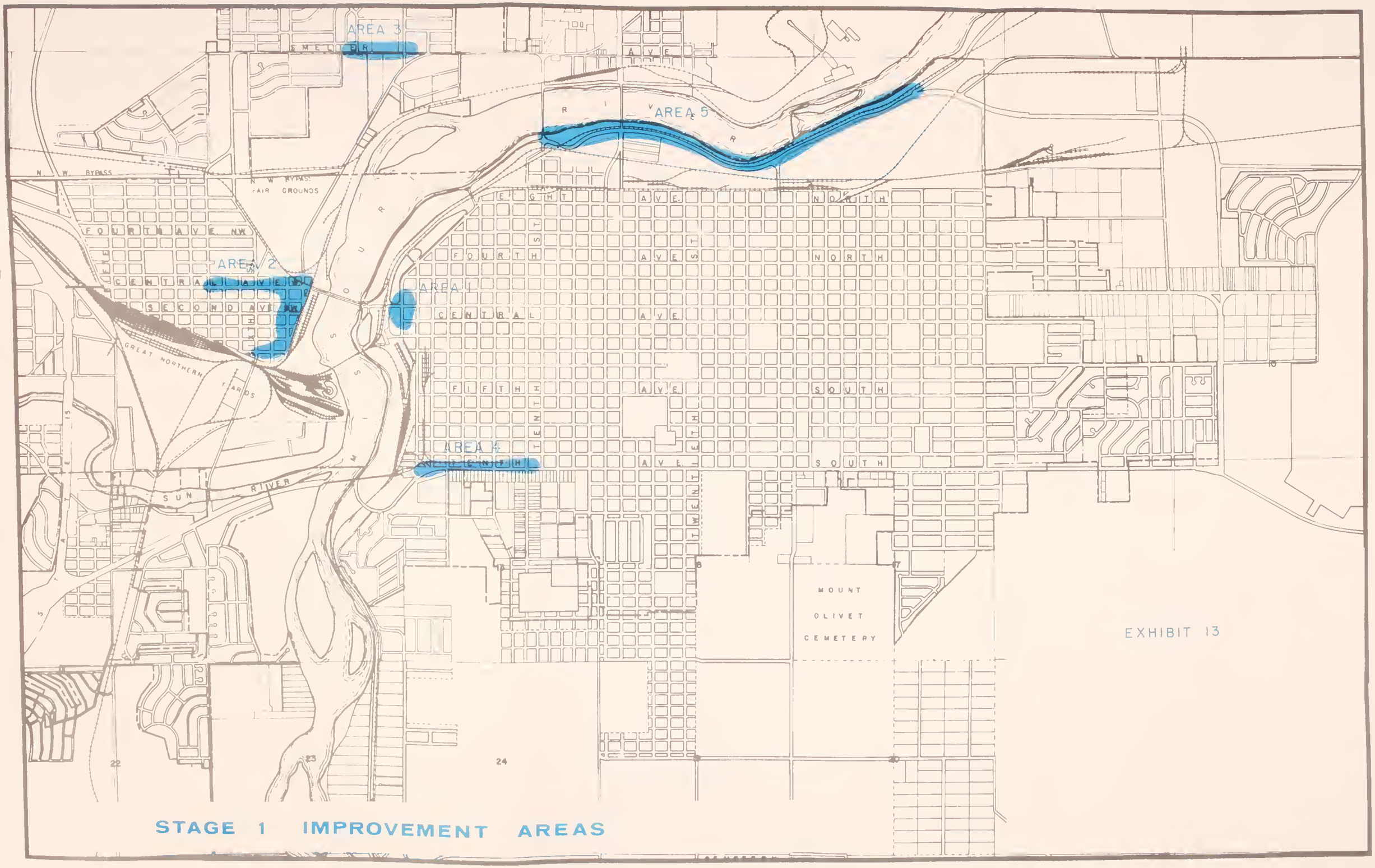
Problem - 10th Street is a major north-south feeder street between 10th Avenue South and River Road, and carries traffic north over the Missouri River. This is a very spacious wide-open intersection. The lack of proper lane assignment and control is causing confusion, delay and some congestion during certain times of the day. Also note the opening statement on Area No. 5 about River Road.

Capacity - This intersection, as in the previous case, is operating below capacity capabilities due in part to lack of signalization, improper night-time lighting, bad alignment and improper delineation of the south approach.

Accidents - Along River Road between 10th Street and Giant Springs Road for the three-year period of 1966-68, there were 96 accidents recorded. Of these, 13 involved injury, 34 were guardrail or delineation deficiencies. Most of these accidents are due to insufficient night-time lighting, improper channelization or delineation and lack of proper traffic control.

Recommended Improvements - Install pin-down and paint channelization utilizing existing right-of-way and paving. Install a standard mast-arm traffic signal actuating the River Road approach. Traffic signal and street light poles should be combined and set back from the shoulder of the roadway at least ten feet wherever possible. However, in many cases this may not be practical because of the steep slope. Also to be included is the improvement of 9th Street to River Road connection by upgrading the guard rail, signing and lighting, from River Road and 10th Street south and west to the railroad overpass at 9th Street. This work is to be coordinated with the overall River Road lighting, striping and guard rail or delineation project. These improvements are being recommended primarily from the standpoint of safety considerations.

Evaluation - These improvements will increase the overall capacity and safety at this intersection by an estimated 30%. With the completion of the improvements along River Road outlined under project #6, #9 and #10, the traffic capacity along River Road will increase an estimated 60%. This increase in capacity is due to proper signalization, pavement markings, signing, lighting and delineation.

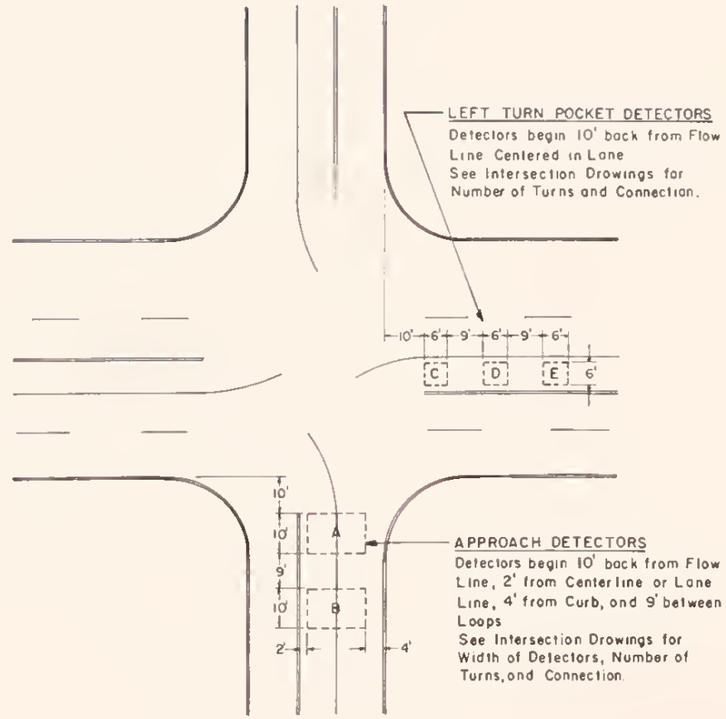


STAGE 1 IMPROVEMENT AREAS

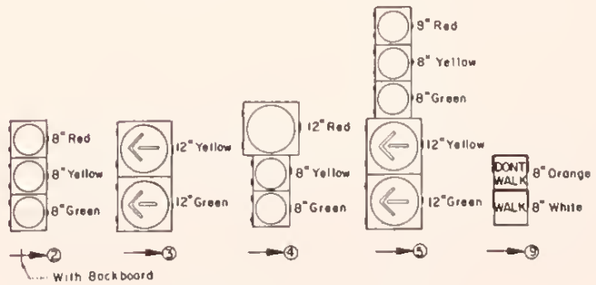
EXHIBIT 14

GREAT FALLS, MONTANA
TOPICS PLAN
STAGE ONE SPOT IMPROVEMENTS

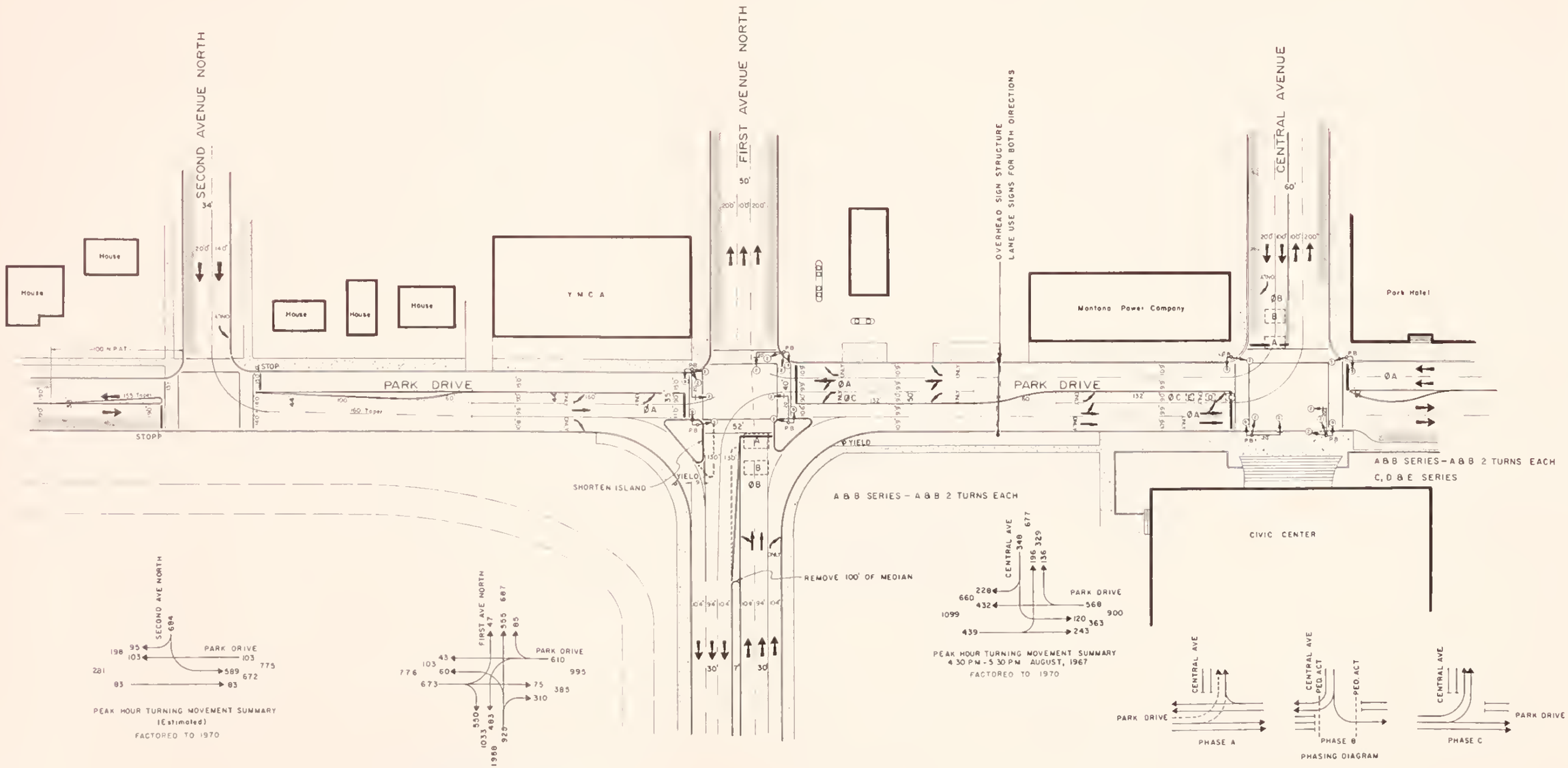
ITEM	DESCRIPTION	UNIT	PARK DR., 1ST AVE NO & CENTRAL AVENUE	CENTRAL AVE WEST & 6TH STREET	RAILROAD AVE & 4TH ST ONE WAY SYSTEM	SMELTER AVENUE & DIVISION ROAD	SMELTER AVENUE & 4TH STREET N.E.	RIVER ROAD & 10TH STREET	10TH AVENUE SO & 3RD STREET	10TH AVENUE SO & 9TH STREET	RIVER ROAD & 25TH STREET NO	RIVER RD.- 10TH ST. TO GIANT SPRINGS RD	CENTRAL AVE WEST & 9TH STREET
			1	2	3	4	5	6	7	8	9	10	11
1	Semi Actuated Controller & Cabinet Complete with Pedestrian Phases	each		1		1	1	1			1		
2	30' Combination Signal and Street Light Pole	each		4		4	4	4			2		
3	12' Signal Mast Arm	each									2		
4	20' Signal Mast Arm	each		4		4	4	4			1		
5	Loop Detector Amplifier	each		1		1	1	1			1		
6	NO 2 Signal Head, 1 Way, 3 Section, 8" Red, Yellow, and Green	each		12		12	12						
7	NO 3 Signal Head, 1 Way, 2 Section, 12" Green and Yellow Arrows	each		1									
8	NO 4 Signal Head, 1 Way, 3 Section, 12" Red, 8" Yellow and Green	each						12			6		
9	NO 9 Pedestrian Signal Head, 1 Way, 2 Section, 8" Orange "Don't Walk", 8" White "Walk"	each		8			4						
10	2" Rigid Conduit	lin. ft.		300		200	200	200			100		
11	#14 - 7 Conductor Signal Cable	lin. ft.		250		350	350	250			180		
12	# 12 - 4 Conductor Signal Cable	lin ft		250		250	250	250			150		
13	# 14 - 2 Conductor Signal Cable	lin ft.		600			500						
14	#14 Single Conductor Detector Cable	lin. ft.		400		250	250	250			250		
15	# 14 - 2 Conductor Shielded Lead-In Cable	lin. ft		200		150	150	150					
16	#10 - 2 Conductor Power Cable	lin. ft.		50		50	50	50			50		
17	Pedestrian Push Buttons and Signs	each		4			4						
18	Signal Head Backboards	each											
19													
20													
21													
22	SR1-2 YIELD	each					2	4			2		
23	SR5-1 DO NOT ENTER	each					2	4			2		
24	SW1-2R Right Curve	each										2	
25	SW1-2L Left Curve	each										2	
26	SW1-6R Right Arrow	each										2	
27	SW1-6L Left Arrow	each										2	
28	SW5-2AR Delineator	each										2	
29	SW5-2AL Delineator	each										2	



TYPICAL LOOP DETECTORS

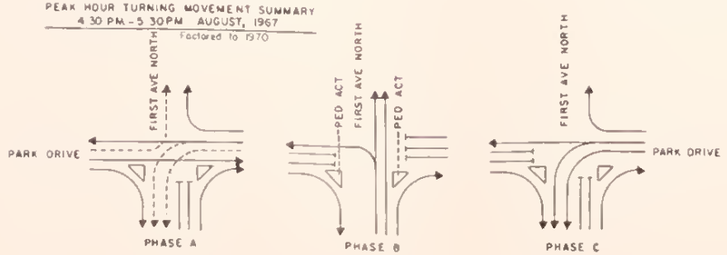


TRAFFIC SIGNAL PANELS



PEAK HOUR TURNING MOVEMENT SUMMARY
(Estimated)
FACTORED TO 1970

PEAK HOUR TURNING MOVEMENT SUMMARY
4 30 P.M. - 5 30P.M AUGUST, 1967
Factored to 1970



PHASING DIAGRAM

PEAK HOUR TURNING MOVEMENT SUMMARY
4 30 P.M - 5 30 P.M AUGUST, 1967
FACTORED TO 1970

PHASING DIAGRAM

PARK DR. & IST AVE. NORTH

SCALE: 1" = 40'

NORTH

EXHIBIT 15

PROJECT NO. 1

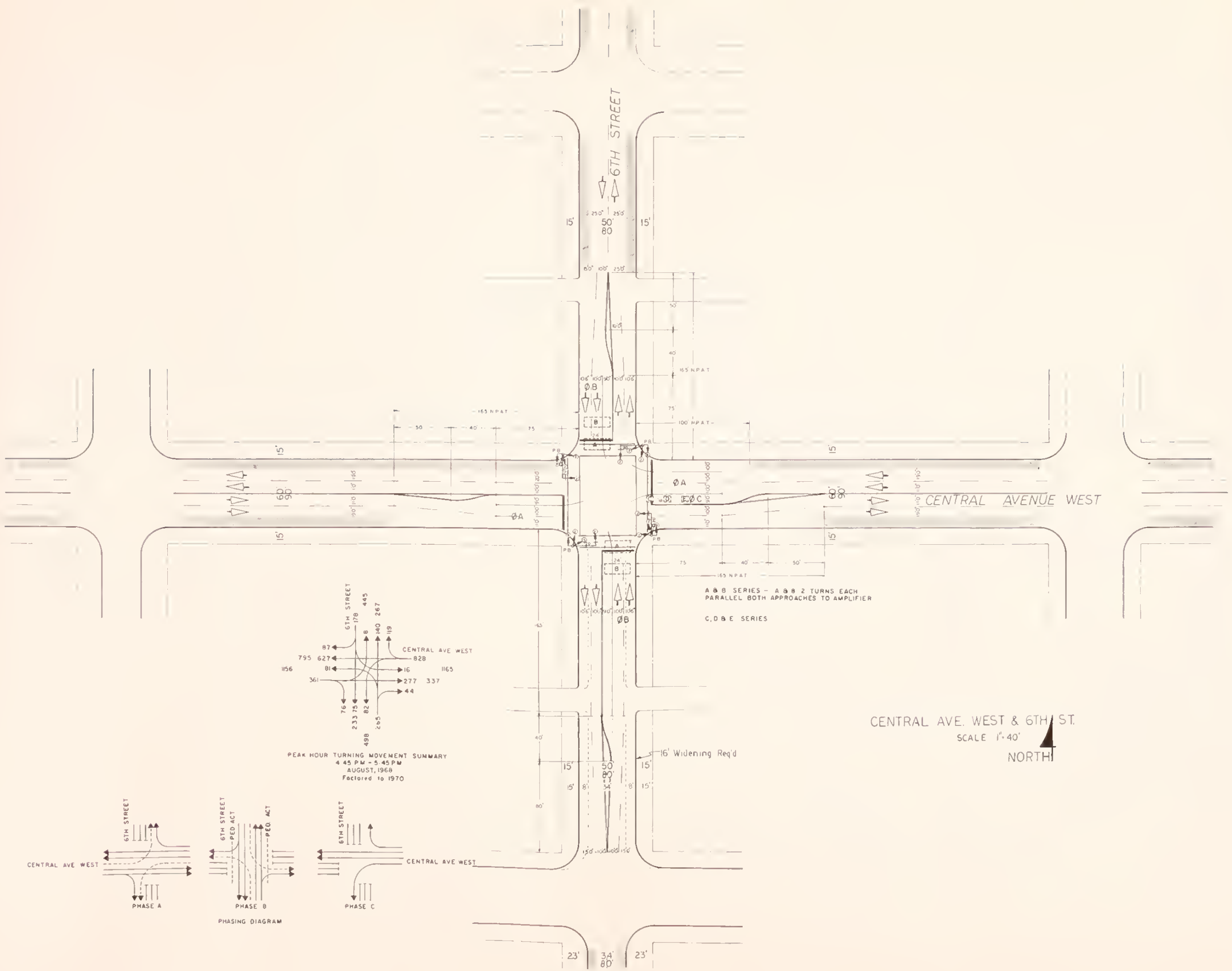
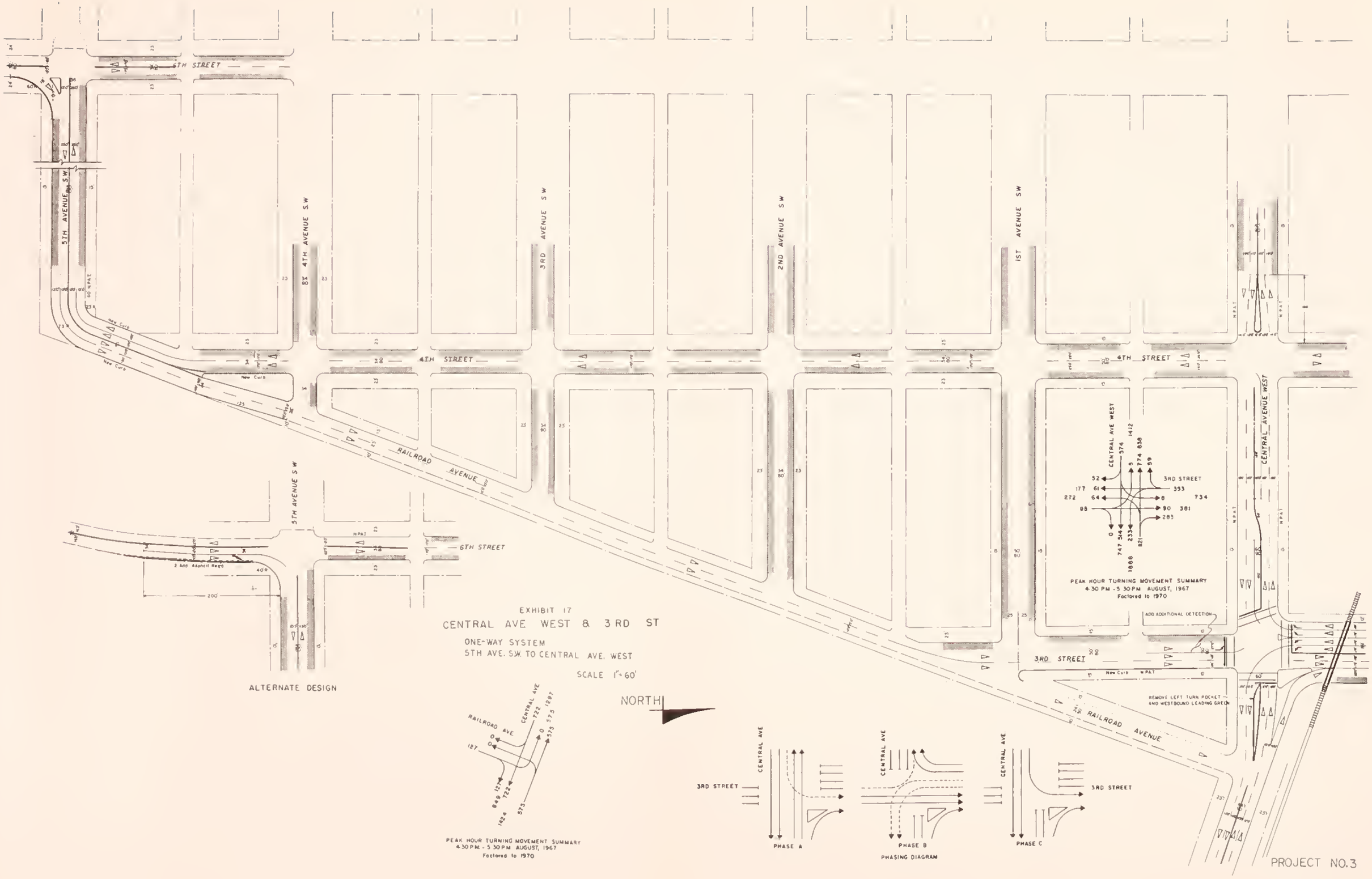
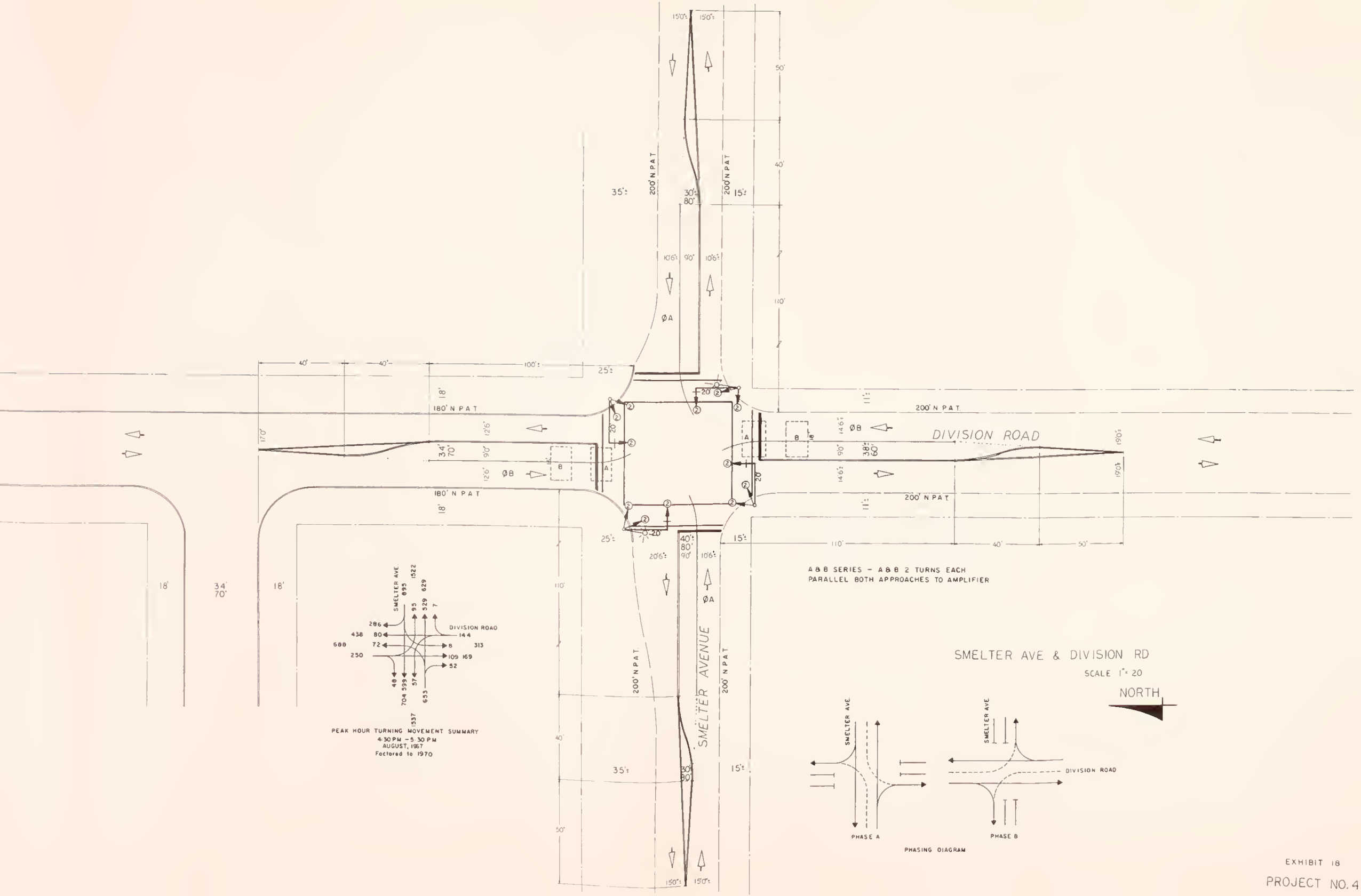


EXHIBIT 16

PROJECT NO. 2


6TH STREET
5TH AVENUE SW
4TH AVENUE SW
3RD AVENUE SW
2ND AVENUE SW
1ST AVENUE SW
4TH STREET
RAILROAD AVENUE
CENTRAL AVENUE WEST
3RD STREET
New Curb
N PAT
ADD ADDITIONAL DETECTION
REMOVE LEFT TURN POCKET — 4ND WESTBOUND LEADING GREEN
PEAK HOUR TURNING MOVEMENT SUMMARY
4:30 PM - 5:30 PM AUGUST, 1967
Factored to 1970
ALTERNATE DESIGN
EXHIBIT 17
CENTRAL AVE WEST & 3 RD ST
ONE-WAY SYSTEM
5TH AVE. SW. TO CENTRAL AVE. WEST
SCALE 1"=60'
NORTH
PHASE A
PHASE B
PHASE C
PHASING DIAGRAM
PROJECT NO. 3


150'±
150'±
50'
40'
35'±
200' N PAT
30'±
80'
15'±
10'6"±
90°
10'6"±
110'
ØA
40'
40'
100'±
25'±
18'
180' N PAT
170'
34'
70'
126'
90°
ØB
B
A
20'
2
DIVISION ROAD
146'±
38'±
60'
190'±
11'±
110'
40'
50'
20'6"±
106'±
SMELTER AVENUE
SMELTER AVE
895
1322
95
529
629
7
286
438
80
144
688
72
8
313
230
109
169
52
48
704
599
57
633
1537
PEAK HOUR TURNING MOVEMENT SUMMARY
4:30 PM - 5:30 PM
AUGUST, 1957
Factored to 1970
A & B SERIES - A & B 2 TURNS EACH
PARALLEL BOTH APPROACHES TO AMPLIFIER
SMELTER AVE & DIVISION RD
SCALE 1" = 20
NORTH
PHASE A
PHASE B
PHASING DIAGRAM
EXHIBIT 18
PROJECT NO. 4

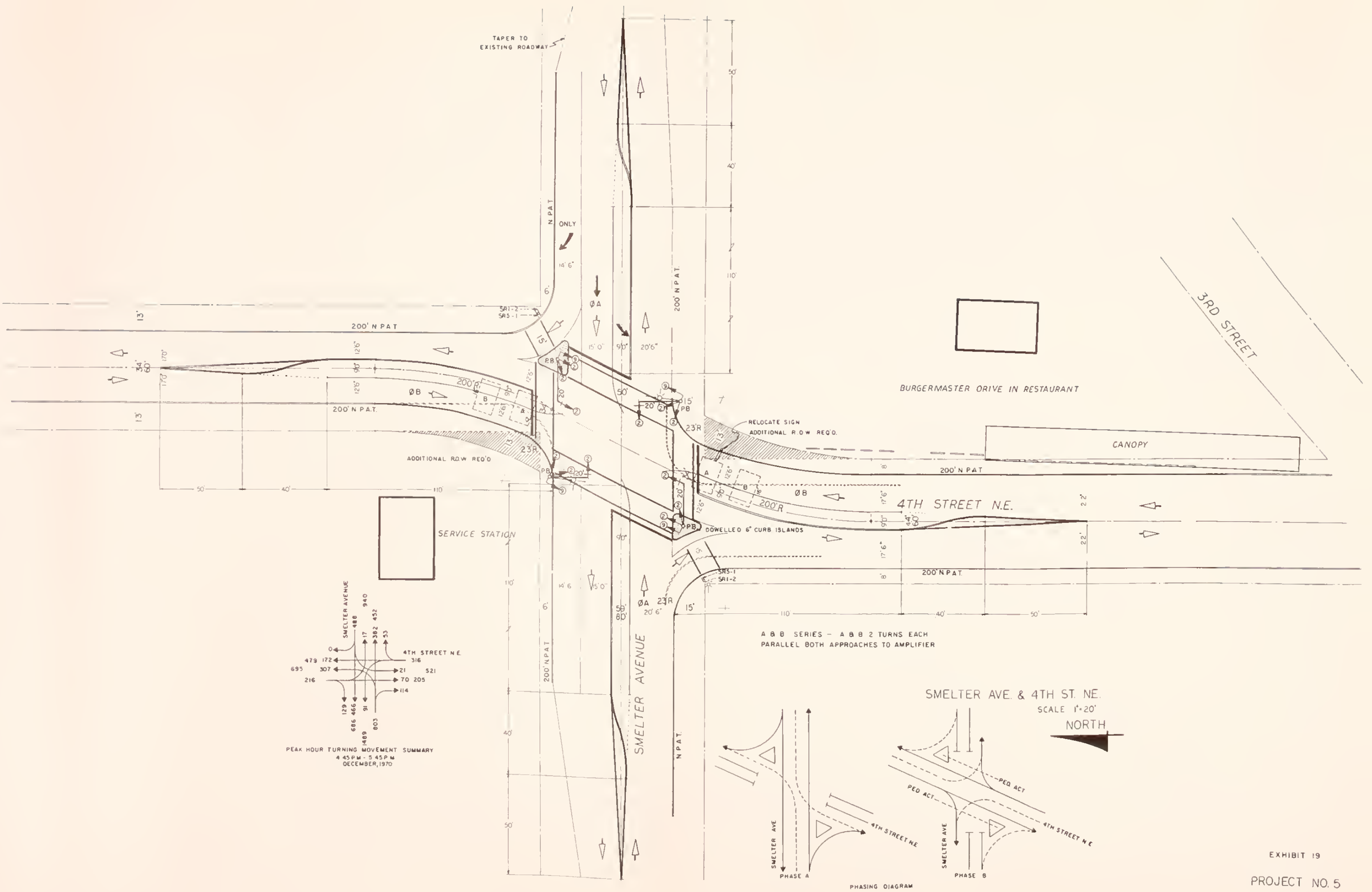


EXHIBIT 19

PROJECT NO. 5

MISSOURI RIVER

10TH ST. BRIDGE

RIVER ROAD

10TH STREET

DOWELLED 6" CURB ISLANDS

ØA

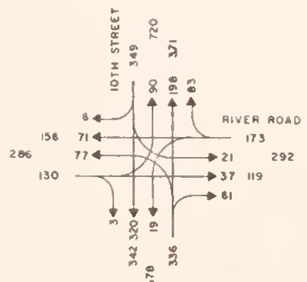
ØB

SR1-2

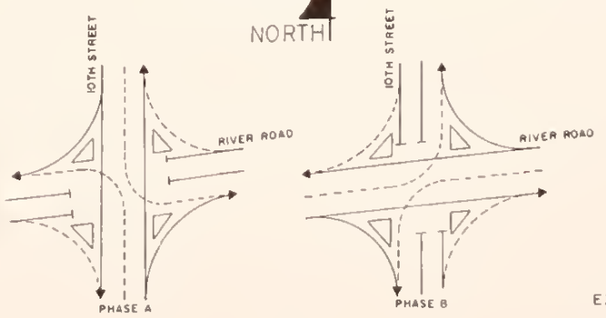
SR5-1

A & B SERIES – A 3 TURNS, B 2 TURNS
PARALLEL BOTH APPROACHES TO AMPLIFIER

PEAK HOUR TURNING MOVEMENT SUMMARY
4:30PM – 5:30PM
AUGUST, 1968
Factored to 1970



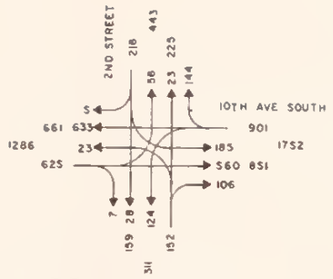
RIVER RD. & 10TH ST.
SCALE 1"=20'
NORTH



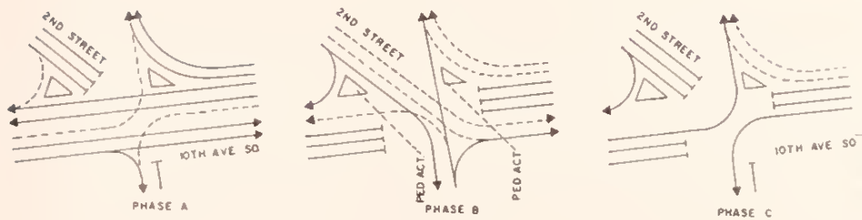
PHASING DIAGRAM

EXHIBIT 20

PROJECT NO. 6



PEAK HOUR TURNING MOVEMENT SUMMARY
4:30 P.M.-5:30 P.M. AUGUST 1968
Factored to 1970



PHASING DIAGRAM

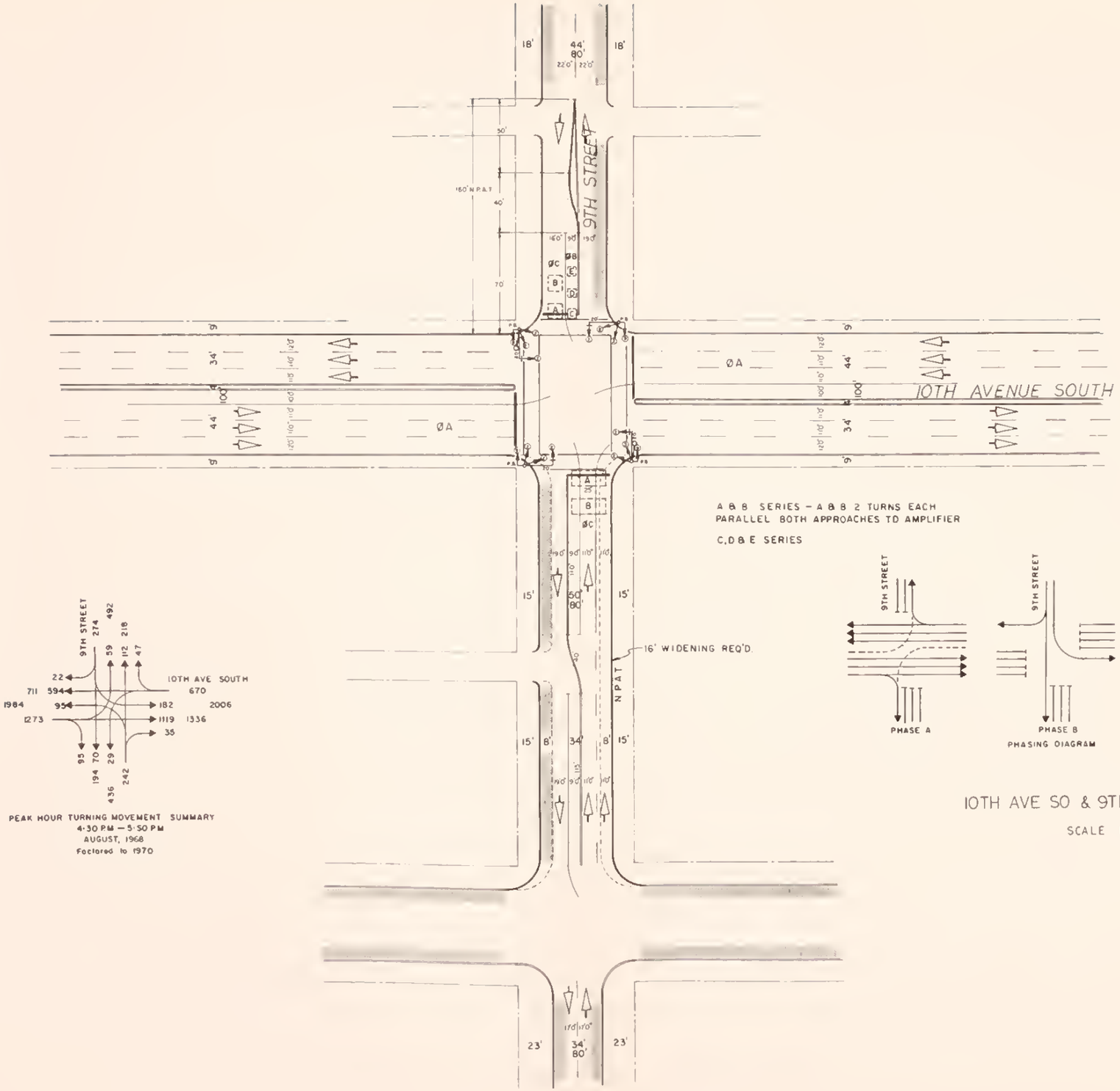
2ND ST. & 10TH AVE. SOUTH

SCALE: 1"=40'

NORTH

EXHIBIT 21

PROJECT NO. 7



A & B SERIES – A & B 2 TURNS EACH PARALLEL BOTH APPROACHES TO AMPLIFIER

C, D & E SERIES

PEAK HOUR TURNING MOVEMENT SUMMARY
4:30 P.M. – 5:50 P.M.
AUGUST, 1968
Factored to 1970

PHASING DIAGRAM

10TH AVE SO & 9TH ST

SCALE 1"= 40'

NORTH

EXHIBIT 22

PROJECT NO. 8

MISSOURI RIVER

RIVER ROAD

GUARD RAIL

SEE PROJECT NO 10

Dowelled 6" Curb Islands

A B B SERIES — A B B 2 TURNS EACH

EXISTING

SR5-1

SR1-2

ØA

ØB

15'R

5'R

250'R

BALL PARK ENTRANCE

25TH STREET

22'6"

35'

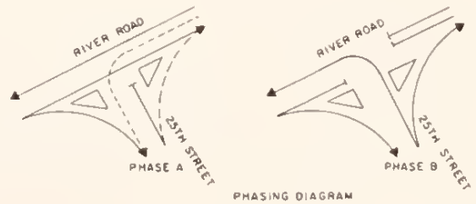
80'

200'

176'

RIVER ROAD 156 311
116 117 155
204 88 38
474 270
133 40 193 126 319
25TH STREET

PEAK HOUR TURNING MOVEMENT SUMMARY
4:30 P.M. - 5:30 P.M. DECEMBER 1970



PHASING DIAGRAM

RIVER RD. & 25TH ST.

SCALE 1"=40'

NORTH

EXHIBIT 23

PROJECT NO. 9

10TH ST. BRIDGE

SEE PROJECT NO 6

RIVER ROAD

15TH STREET BRIDGE

G.N.R.R.

MISSOURI RIVER

RIVER ROAD

C.M.ST.P.&P.R.R.

9TH STREET

GUARD RAIL — 24' ROADWAY

GUARD POSTS

Set Guard Rail & Guard Posts at: 5' from Roadway Minimum
10' from Roadway where Possible

Paint Double Yellow Centerline Entire Length

Provide Lighting Entire Length at Approx. 400' Spacing

GIANT SPRINGS ROAD

RIVER ROAD

MISSOURI RIVER

BLACK EAGLE DAM

G.N.R.R.

RIVER ROAD
9TH ST. TO GIANT SPRINGS RD.
SCALE 1" = 200'

NORTH

SEE PROJECT NO 9

RIVER ROAD

25TH STREET

C.M.ST.P.&P.R.R.

EXHIBIT 24
PROJECT NO. 10

CENTRAL AVE WEST & 9TH ST

SCALE 1" = 20'

NORTH

9TH STREET

N PAT

CENTRAL AVENUE WEST

REBUILD MEDIAN

PAINT MEDIAN

EXISTING SIGNAL POLE

EXISTING SIGNAL & STREET LIGHT POLE

ØA

ØB

A

B

PB

20'

15'

44'

66'

100'

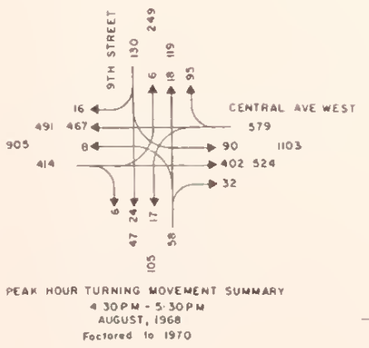
75'

40'

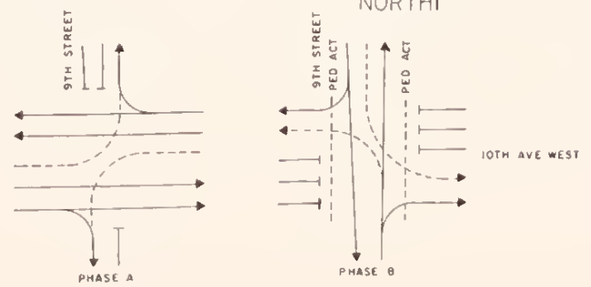
50'

165' N PAT

A & B SERIES - A & B 2 TURNS EACH
PARALLEL BOTH APPROACHES TO AMPLIFIER



PEAK HOUR TURNING MOVEMENT SUMMARY
4:30 PM - 5:30 PM
AUGUST, 1968
Factored to 1970



PHASING DIAGRAM

EXHIBIT 25

PROJECT NO. 11

TABLE 5

STAGE ONE IMPROVEMENT PROJECT

AREA 1

COST ESTIMATES

1. Park Drive - Central Avenue to 1st Avenue North

Item	Unit Cost	Total
1. Remove 700' of median	2.15	$ 1,505
2. Replace 700' concrete structure slab - 26 cubic yards at	100.00	2,600
3. Remove 400' of island	3.50	1,400
4. Replace 400' of concrete structure slab - 16 cubic yards at	100.00	1,600
5. Signal revision, including loops, etc. at both 1st Avenue and Central	Lump Sum	7,000
6. Striping, signing and pavement markings	Lump Sum	500
Total		$14,605
Plus 35% for recent cost increases, engineering and contingencies:		$19,700

STAGE ONE IMPROVEMENT PROJECT

AREA 2
COST ESTIMATES

1. Central Avenue West and 6th Street

Item	Unit Cost	Total
1. Curb removal 380 lin. ft.	1.00	$ 380
2. Curb replacement 380 ft.	4.00	1,520
3. Sidewalk removal and replacement - 3,000'	.75	2,250
4. Repave 835 yds.	6.00	5,010
5. New signal	Lump Sum	9,000
6. Paint, signs, etc.	Lump Sum	1,000
Total		$19,160
+ 35%		$25,900

2. 4th Street and Railroad Avenue One-Way Couplet

1. Channelize with pindown curb and paint various intersections	Lump Sum	$ 5,000
2. Radius improvements		
(a) 6th St. & 5th Ave. S.W.	Lump Sum	2,500
(b) 4th St. & 5th Ave. S.W.	Lump Sum	1,500
3. Revise signal at 3rd St. & Central	Lump Sum	500
4. Signs for entire project	Lump Sum	1,000
5. Incidentals	Lump Sum	1,000
Total		$11,500
+ 35%		$15,500

3. Central Avenue West and 9th Street

1. Upgrade signal	Lump Sum	$ 1,000
2. Restripe and channelize (paint)	Lump Sum	800
3. Resign and incidental	Lump Sum	1,000
Total		$2,800
+ 35%		$3,800

STAGE ONE IMPROVEMENT PROJECT

AREA 3

COST ESTIMATES

1. Smelter Avenue and Division Road

Item		Unit Cost	Total
1. New signal installation		Lump Sum	$ 8,000
2. Signing, pavement markings, etc.		Lump Sum	500
	Total		$ 8,500
	+ 35%		$11,50[illegible]

2. 4th Street Northeast and Smelter Avenue

1. Move Burgermaster sign		Lump Sum	$ 1,500
2. Right-of-way cost		Lump Sum	4,000
3. Curb removal, 300 feet		1.00	300
4. New curb, 300 feet		4.00	1,200
5. Repair paving		Lump Sum	1,000
6. New signal		Lump Sum	8,000
7. Channelize, signs, etc.		Lump Sum	500
	Total		$16,500
	+ 35%		$22,300

STAGE ONE IMPROVEMENT PROJECT

AREA 4

COST ESTIMATES

1. 9th Street and 10th Avenue South

	Item	Unit Cost	Total
1.	Curb removal - 675'	1.00	$ 675
2.	Curb replacement - 675'	3.00	2,025
3.	S. W. removal and replacement 3,000	.60	1,800
4.	Paving for widened sections, 600 yds.	7.00	4,200
5.	Signal revision - 9th St.	Lump Sum	4,000
6.	Signs, striping and incidentals	Lump Sum	1,400
	Total		$14,100
	+ 35%		$19,000

2. 2nd Street and 10th Avenue South Revision

1.	Grading and excavation - 2000 cu. yds.	1.40	2,800
2.	Paving (including base, leaving, surface, seal and cover) 1,700 yds.	9.00	15,300
3.	Curb - pindown in place - 300 lin. ft.	4.00	1,200
4.	Curb - Int. curb and gutter - 400'	5.00	2,000
5.	Signal revision	Lump Sum	5,000
6.	Signing	Lump Sum	400
7.	Pavement Marking	Lump Sum	300
	Total		$27,000
	+ 35%		$36,500

STAGE ONE IMPROVEMENT PROJECT

AREA 5

COST ESTIMATES

1. 10th Street and River Road
(including improvements to dog leg)

Item	Unit Cost	Total
1. Channelization and paving of intersection	Lump Sum	$ 7,200
2. Signal installation	Lump Sum	10,000
3. Guard rail and delineation 300' @	6.00	1,800
4. Signing, striping and incidentals	Lump Sum	2,500
Total		$21,500
+ 35%		$29,000

2. River Road and 25th Street

1. Channelize	Lump Sum	2,500
2. Additional paving	Lump Sum	4,000
3. New signal	Lump Sum	10,000
4. Signing and incidentals	Lump Sum	1,000
Total		$17,500
+ 35%		$23,600

3. Guard rail and Delineation on River Road
From 10th Street to Giant Springs Road

1. 7,100' guard rail	6.00	$42,600
2. Delineation, striping and signing	Lump Sum	2,400
Total		$45,000
+ 35%		$60,800

STAGE 2 IMPROVEMENT PROGRAM:

Within the Study Area there are numerous other improvements that should be considered. They consist mainly of improvements oriented towards safety considerations.

Primarily the work to be accomplished will be for improved signing, lighting, intersection approach treatment by use of proper channelization techniques, improved pavement markings, signal control, etc. A total of 12 locations has been selected for the Stage 2 Improvement Program, as listed in Table 6, Page 69. At the time of this writing these areas were those considered deficient, but when new developments occur and traffic volumes increase on other segments of the street network, additional improvements will become necessary. It is recommended that the community keep close surveillance on additional problem areas as they become evident and institute a program for continued updating of the traffic operations plan as growth occurs.

10TH AVENUE SOUTH IMPROVEMENTS:

The startling increase in traffic volumes on this important arterial route has prompted recommendations in the past for increasing the operating efficiency and capacity by converting the arterial from a four-lane to a six-lane facility. This was first recommended in the Transportation Plan of 1961 and again recommended in the Transportation Plan Update of 1968.

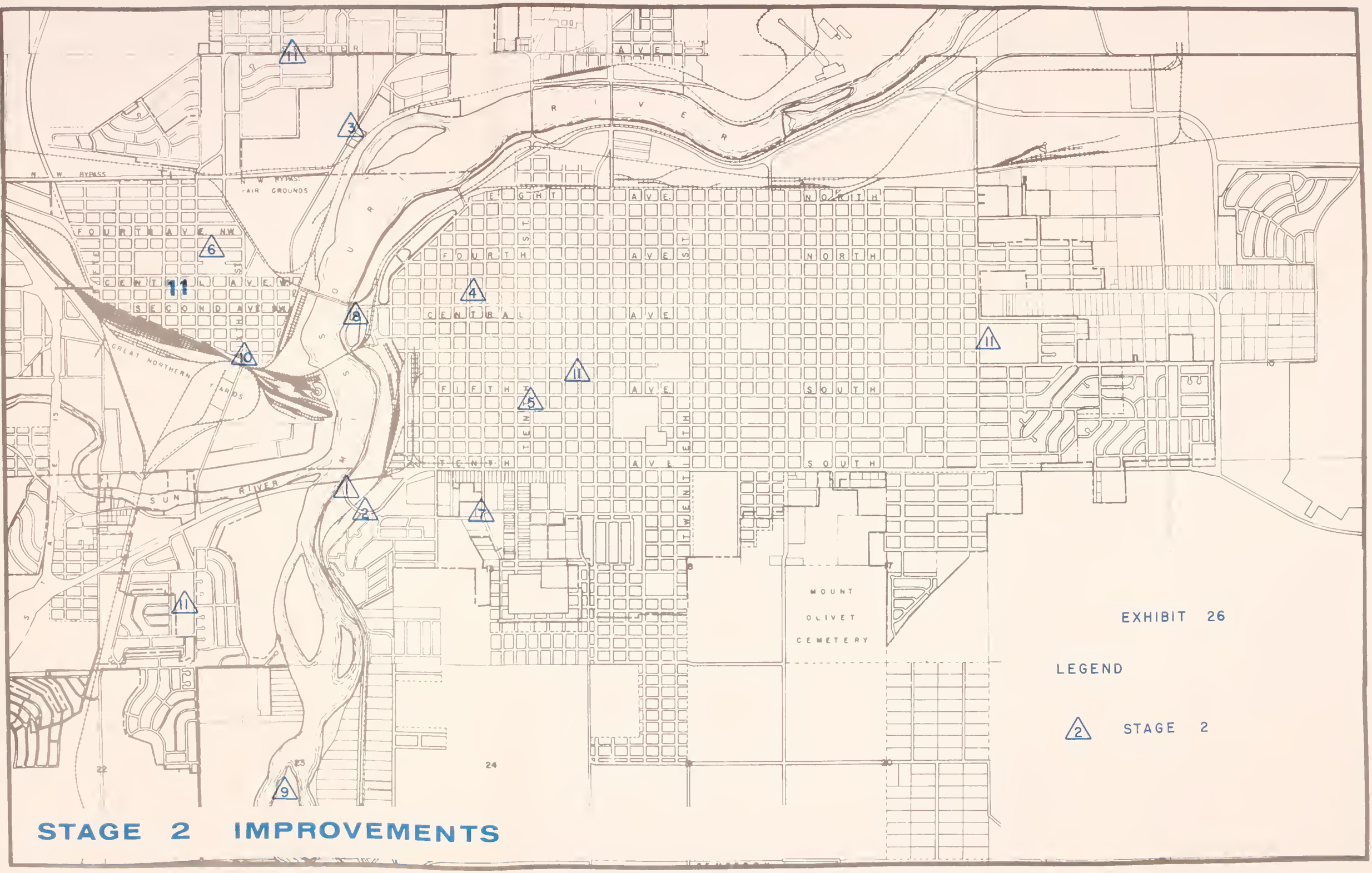

N W BYPASS
FAIR GROUNDS
RIVER
EIGHTH AVE NORTH
FOURTH AVE NW
FOURTH AVE NORTH
CENTRAL AVE
SECOND AVE NW
CENTRAL AVE
GREAT NORTHERN YARDS
FIFTH AVE SOUTH
TENTH AVE SOUTH
1ST ST W
SUN RIVER
MOUNT OLIVET CEMETERY
EXHIBIT 26
LEGEND
STAGE 2
STAGE 2 IMPROVEMENTS

TABLE 6

STAGE 2 IMPROVEMENTS

	Location	Project Description	Estimated Cost
1.	River Road & 10th Ave. So. Loop	Widen south approach, channelize, new guard rail installation, provide lighting, upgrade signing and pavement markings	$25,000
2.	Upper River Rd. & 10th Ave. So. Loop	Channelize, provide lighting and upgrade signing and pavement markings	2,500
3.	Div. Rd. Exten. at 3rd St. N. W.	New signal installation	10,000
4.	Central Business District	Widen from 34' to 50': (a) 7th St., 1st No. to 2nd No. (b) 7th St., 1st So. to 2nd So. (c) 8th St., 1st No. to 2nd No.	24,000
5.	9th St. & 6th Ave. So.	Remove or actuate signal	1,000
6.	Central West & 5th St.	Remove or actuate signal	1,000
7.	13th Ave. So. & 7th St.	Realignment of 13th Ave. So., including right-of-way purchase	5,000
8.	River Rd. & Mitchell Pool exit	Improve sight distance and signing	2,500
9.	Lower River Rd. south of 10th Ave.	Guard rail renewal	25,000
10.	6th St. S.W. & 5th Ave. S.W.	Additional channelization and signal installation	12,000
11.	Mid-block School Crossings	Pedestrian actuated school crossings at:	
		(a) Riverview Elementary	3,000
		(b) Lewis & Clark Elementary	3,000
		(c) Lady of Lourdes	3,000
		(d) Meadowlark Elementary	3,000
12.	Area Wide	Sign upgrading	60,000
		TOTAL STAGE 2 IMPROVEMENTS	$180,000

10th Avenue South is currently on the Federal-Aid Primary Type 1 System and as such, major construction or reconstruction would normally be funded under the Primary Funding Program as opposed to "TOPICS" funding. However, since the improvements recommended herein are considered to be typical "TOPICS"-type improvements as opposed to major reconstruction, and further since Primary Funds are unavailable to implement these recommendations, they are being recommended for implementation under "TOPICS."

At the present time lighting is provided by light standards installations located in the narrow median with eight fixtures per block (two fixtures per standard), consisting for the most part of 20,000 lumen fixtures, with some sections containing only 6,000 lumen fixtures.

The lighting system as now constructed provides very poor illumination, with average intensity being in the range of 0.70 foot candles on the driving surface in the best illuminated areas. In addition, the location of the light standards in the narrow median has proved to be a prime factor in a number of serious accidents. 1967 accident records show 34 fixed object accidents, 23 involving a light pole on the median. The cost of replacement of these standards is also high.

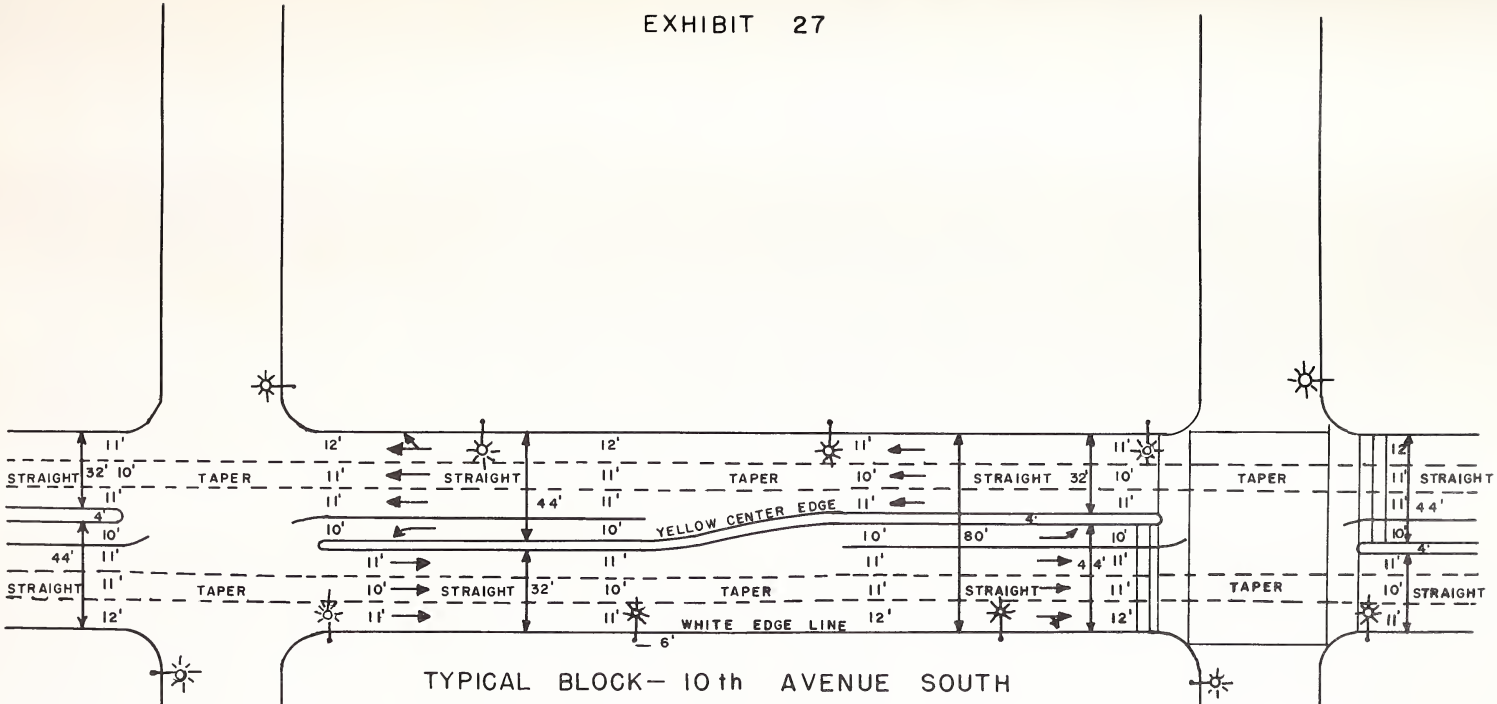
It is therefore recommended that the lighting system be completely revised, as shown on Exhibit 27, Page 71, with the lighting fixtures to be removed from the median and relocated outside the curbed areas. The new system will be composed of six fixtures per block staggered spacing, with 400-watt sodium vapor units, which will increase the average lighting intensity to about 2 foot candles on the driving surface.

In addition to the lighting revision, restriping of the facility is recommended, as shown on Exhibit 27, Page 71. Although the conversion to six lanes will result in some lanes being narrower than the desired 12 feet, it is felt that the conversion as recommended will provide considerably improved operating efficiency and coupled with the relighting program, should substantially increase the safety along the entire route.

It should be noted that surface conditions on 10th Avenue South are generally poor, particularly for what would be the outside lanes, if the present facility were restriped for a six-lane operation. This, of course, will require a major overlay or reconstruction program, which obviously is beyond the scope of this "TOPICS" Program.

Six-lane operation will also necessitate better enforcement regarding advertising signs being placed on the public right-of-

EXHIBIT 27



TYPICAL BLOCK— 10th AVENUE SOUTH

way. These signs restrict sight-distance, cause motorists to drive further from the curb and are a hazard that can be eliminated through better enforcement.

An additional possibility which should be explored would be that of removing entirely the raised median along the entire route and providing left-turn bay and traffic separation with paint (double yellow). Since a goodly portion of the existing median is cast-in-place concrete, it is expected that removal of the median and subsequent resurfacing would be a costly project. On the other hand, it would provide wider traffic lanes and additional "shy" distance on the outside lanes, which would result in safer operation for the relatively fast-moving traffic.

In summary, with traffic volumes already being extremely heavy and expected to continue to increase, six-lane operation is almost a necessity. Before six-lane operation can be put into effect, street light poles must be removed from the median and surface conditions of the roadway must be improved, particularly in the outside lanes so that traffic can move safely. Advertising signs must be moved back from the curbs off the public right-of-way, through strict enforcement. Also, median removal should be given more study and serious consideration as traffic volumes increase.

CENTRAL BUSINESS DISTRICT ONE-WAY GRID PROPOSAL:

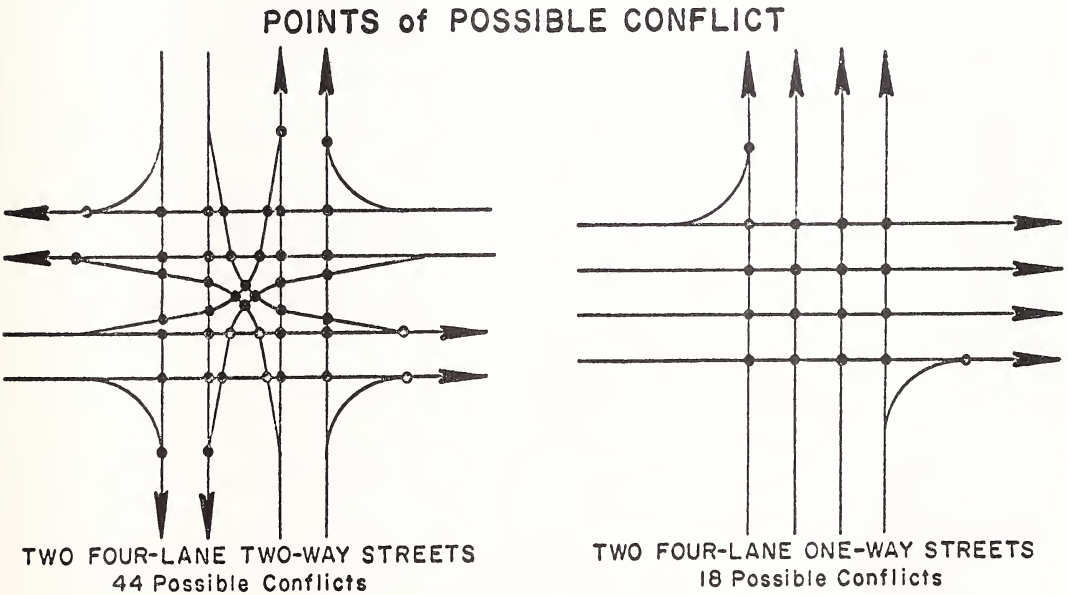
The Transportation Plan Update did relate a number of deficiencies in the Central Business District. There were a number of intersections that were determined to be operating below an acceptable level of service. Long-range proposals of the Update Plan were for extending the one-way couplet system to include additional streets leading traffic to and from the Central Business District. From the standpoint of capacity, such a proposal could meet current and long-range projected needs to resolve the major problem of traffic entering and leaving the Central Business District.

When reviewing these recommendations for the Traffic Operations Plan, it became apparent that considerations other than corridor capacity should be investigated. For instance, in addition to major corridor traffic, the overall circulation in the Central Business District and the convenience and safety of the traveling public would be better improved through a complete one-way grid system. Such a system could be incorporated into the Transportation Plan and would not necessarily require extensive capital outlay and reconstruction to be effective.

Several reasons exist for conversion to a complete one-way operation. In general, one-way streets are used because they are

more efficient and safer than two-way streets. They relieve traffic congestion and promote automobile and pedestrian safety.

One-way streets organize traffic better for improved operation and circulation, allow better progressive signal timing, solve the left-turn problem inherent in two-way street systems, allow better use of multi-lane turns, develop a more efficient use of street widths and reduce vehicular and pedestrian conflicts, as shown on the following diagram.



In addition, one-way streets are safer because of less conflicts in the flow pattern. The one-way direction of traffic eliminates the problem of head-on collisions, and pedestrians can cross one-way streets much easier. It should also be noted that night-time safety is improved by the elimination of on-coming traffic headlight glare.

OPERATIONAL CHARACTERISTICS AND CIRCULATION:

A street must accept traffic from other streets easily and then must distribute that traffic to desired destinations, including other streets, curb or off-street parking areas and through curb cuts to other automobile-oriented uses such as drive-ins and service stations.

Two-way streets have difficulty in distributing traffic primarily because much of the traffic desires to turn left in the face of the opposing flow which has the right-of-way; further, parking spaces on the left side of a two-way street cannot be reached.

On the other hand, one-way streets distribute their traffic to the left or right with equal ease. Parking spaces and curb access on both sides of a one-way street are open to all motorists. Businessmen often resist one-way operation because they fear the effect of having only half of the traffic passing their door, yet it is easy to demonstrate that if motorists are properly directed through public and private announcements, and when motorists have developed experience with one-way street systems, businessmen will receive the benefits of the better and safer mobility and access developed by a pair of one-way streets.

SIGNAL TIMING:

In modern street operation a great deal of emphasis is placed upon the smooth flow of traffic controlled by traffic signals. The most efficient, the most accident-free, and the most pleasurable to drive upon is a street system which maintains a reasonably constant and uniform speed throughout. Stop and start driving destroys all three of these attributes.

Two-way streets can provide this desirable flow if proper spacing of traffic signals can be maintained. In most central business districts where signals are spaced less than 1/4 mile or 1,250 feet, progression in both directions cannot be maintained. Signal spacing in the Central Business District area is approximately 400 feet. Also, to solve the left-turn circulation problem of two-way streets, invariably many added left-turn signal phases have to be installed or left-turn restricted. Today all turns are restricted between the hours of 7:00 a.m. to 6:00 p.m., along Central Avenue at 3rd, 4th and 9th Streets, in order to relieve the back-up in a through lane. Where left-turn phases are added, additional delay to through traffic is apparent and further restricts the ability to provide smooth progressive signal timing and flow, providing, as stated above, spacing of signals is approximately 1,250 feet.

On a one-way street system there is much less difficulty in obtaining uniform flow and better efficiency because the spacing of the signals is no longer a major factor and the adding of special left-turn phase or restricting the left-turn movement is seldom required. A smooth progression can be provided even with traffic signals every block.

VEHICULAR AND PEDESTRIAN CONFLICTS, LEFT-TURN PROBLEMS AND MULTI-LANE TURNS:

One indication of the accident potential of an intersection is the number of vehicular conflicts. Comparing the intersection of two-way streets and any one-way street, there are twice as many points of conflict as any two one-way streets.

Left-turns from a two-way street, unless provided with separate left-turn storage bays, cause major delays to through-lane traffic. This is apparent today along Central Avenue where left-turns are prohibited because there are no left-turn storage bays. One-way streets solve the left-turn problem inherent on two-way streets and even allow a multi-lane turn design which is difficult, or in some cases impossible, to install with two-way operation.

CENTRAL BUSINESS DISTRICT ONE-WAY GRID SYSTEM:

In developing a plan to relieve congestion and reduce accidents in the Central Business District, it was determined that the most practical solution would be a one-way grid system. Three plans were considered, each having its individual advantages and disadvantages, but each plan providing a vastly improved traffic operations system in the Central Business District.

Plan 1

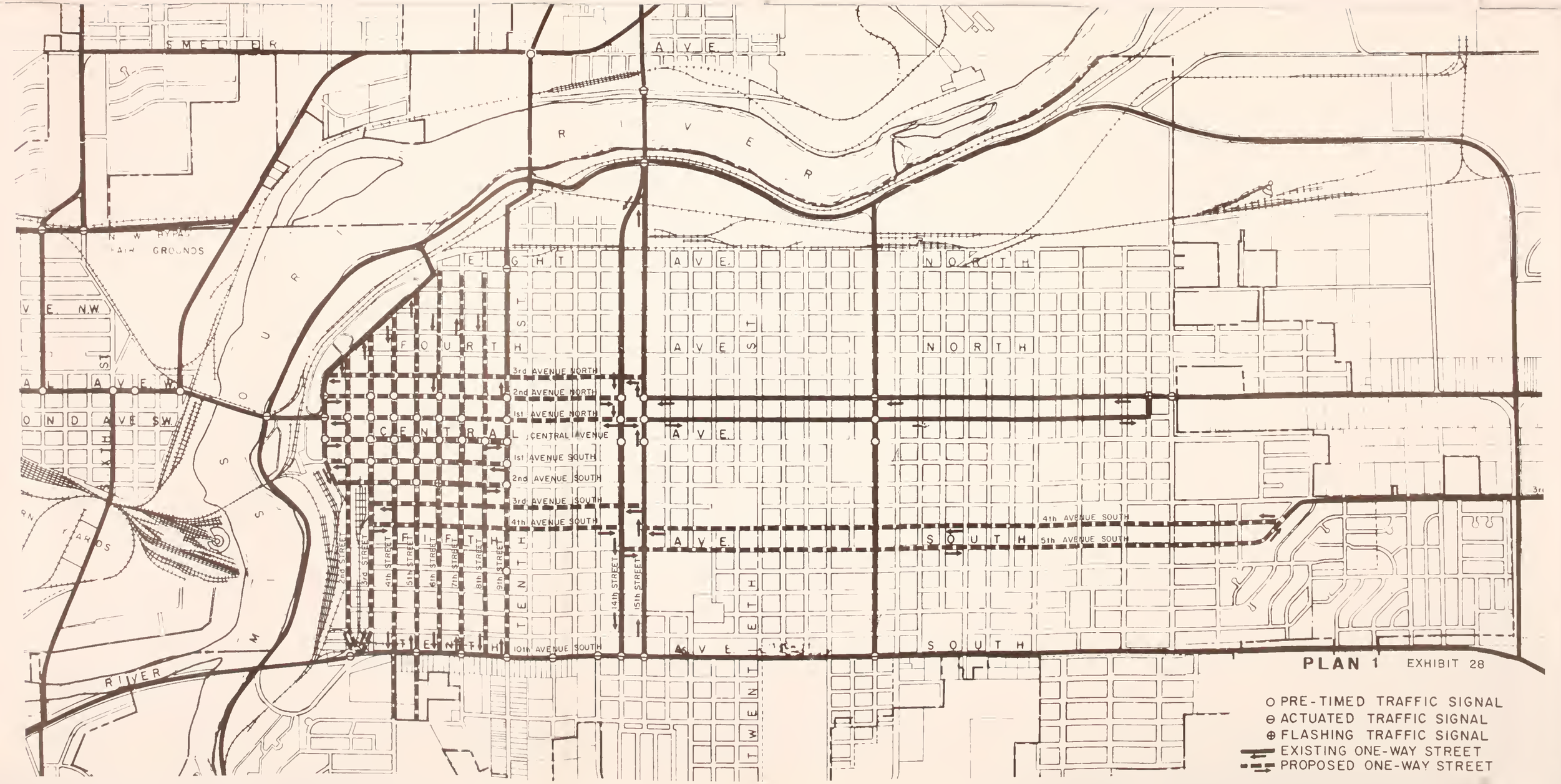
The first plan considered was a total grid system, including Central Avenue, as shown on Exhibit 28, Page 76. (See Typical Timing Plan attached for one-way grid.) The major disadvantages of this plan are:

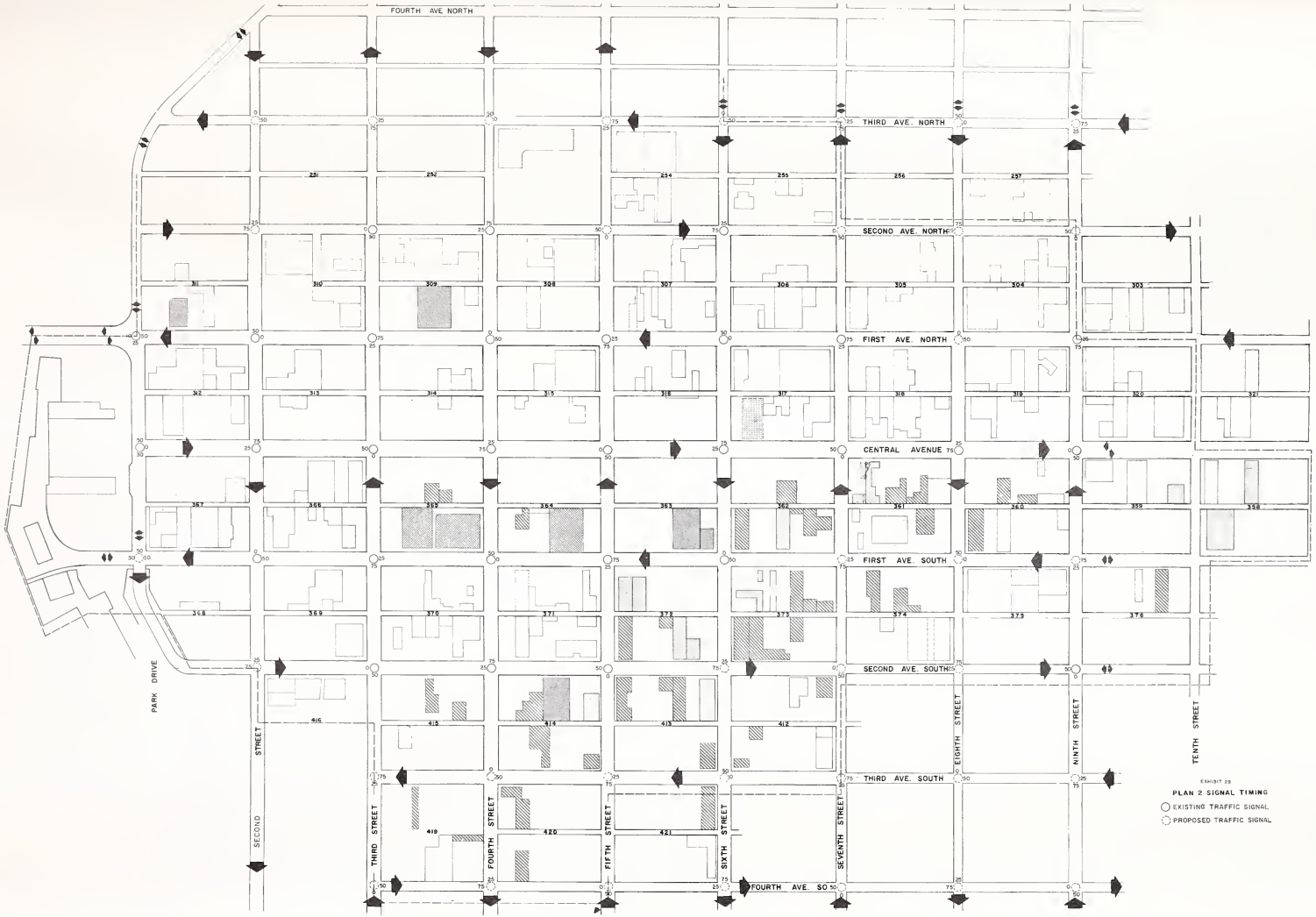
1. The required reversal of the direction of flow of traffic on 1st and 2nd Avenues North from Park Drive to 15th Street.

2. The requirement for transitions at 14th and 15th Streets for continuation of the one-way couplet east of 14th and 15th Streets.

   The need for a transition was indicated because reversal of direction of flow on the couplet was not deemed feasible east of 15th Street.

3. Transition at 14th and 15th Streets for the future one-way couplet of 4th and 5th Avenues east of 15th Street transitioning into the one-way couplet of 3rd and 4th Avenues west of 14th Street.


EIGHTH AVE. NORTH
AVE. NORTH
RIVER
3rd AVENUE NORTH
2nd AVENUE NORTH
1st AVENUE NORTH
CENTRAL AVENUE
1st AVENUE SOUTH
2nd AVENUE SOUTH
3rd AVENUE SOUTH
4th AVENUE SOUTH
5th AVENUE SOUTH
10th AVENUE SOUTH
FOURTH AVE.
CENTRAL AVE.
TENTH AVE. SOUTH
TWENTY
2nd STREET
3rd STREET
4th STREET
5th STREET
6th STREET
7th STREET
8th STREET
9th STREET
14th STREET
15th STREET
N.W. BYPASS
FAIR GROUNDS
RIVER
PLAN 1 EXHIBIT 28
PRE-TIMED TRAFFIC SIGNAL
ACTUATED TRAFFIC SIGNAL
FLASHING TRAFFIC SIGNAL
EXISTING ONE-WAY STREET
PROPOSED ONE-WAY STREET


FOURTH AVE NORTH
THIRD AVE. NORTH
SECOND AVE. NORTH
FIRST AVE. NORTH
CENTRAL AVENUE
FIRST AVE. SOUTH
SECOND AVE. SOUTH
THIRD AVE. SOUTH
FOURTH AVE. SO
PARK DRIVE
SECOND STREET
THIRD STREET
FOURTH STREET
FIFTH STREET
SIXTH STREET
SEVENTH STREET
EIGHTH STREET
NINTH STREET
TENTH STREET
EXHIBIT 29
PLAN 2 SIGNAL TIMING
EXISTING TRAFFIC SIGNAL
PROPOSED TRAFFIC SIGNAL

East of 15th Street, 4th and 5th Avenues South are the only avenues that extend uninterrupted to the connection to 3rd Avenue South at approximately 46th Street.

Plan 2

Under the second plan considered, a "modified" one-way grid was developed. Under this plan, Central Avenue remains a two-way arterial, as shown on Exhibit 30, Page 79. The major disadvantages of this plan over others considered are:

1. The reduction in effective overall efficiency. The reduction in efficiency is caused by signal timing problems created by two-way Central, as outlined earlier, as well as the inability of the system to eliminate the left-turn conflicting movements at the intersections on Central Avenue. (See Typical Timing Plan attached for Modified One-Way Grid.)

2. With Central Avenue being a two-way arterial, some parking restrictions may be required at a number of intersection approaches to provide room for separate lanes to handle the necessary left-turn movements.

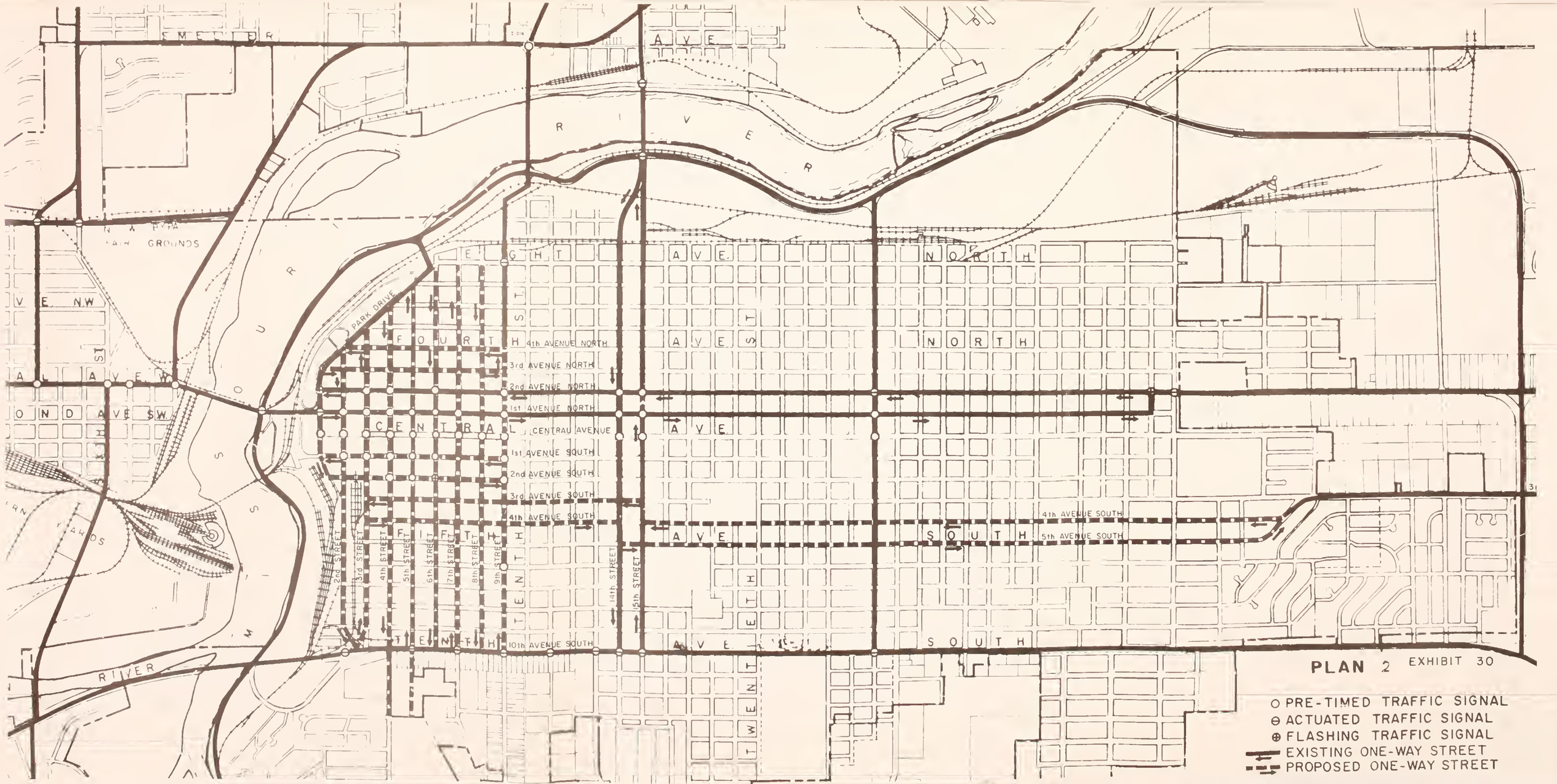
The major advantages of this plan over the others are that it would not require reversing the direction of flow on any of the existing one-way couplets and as such would cause much less concern on the part of the business community for the area affected.

Plan 3

Under Plan 3 the total grid concept again was considered. However, under this plan a reversal of direction of flow on the existing one-way couplet of 1st and 2nd Avenues South was required and Central Avenue would be a westbound one-way arterial, as shown on Exhibit 28, Page 76. The major advantage of this plan over Plan 1 was the elimination of the transitions on 1st and 2nd Avenues North and on 4th and 5th Avenues South at 15th Street, while at the same time providing all the other advantages of a total one-way grid and giving better over-all coordination and use of the existing street system. (See Typical Timing Plan attached for One-Way Grid.)

Although Plan 3 does provide for the best circulation and traffic patterns throughout the area, it does pose some problems relating to construction projects now underway, or in the advanced planning stages. Two examples are:

1. The Sears building program well underway at this time. It is designed with an off-street, multi-story



PLAN 2 EXHIBIT 30

- ○ PRE-TIMED TRAFFIC SIGNAL
- ⊖ ACTUATED TRAFFIC SIGNAL
- ⊕ FLASHING TRAFFIC SIGNAL
- EXISTING ONE-WAY STREET
- PROPOSED ONE-WAY STREET

parking structure with an exit ramp leading on to 1st Avenue South in the direction of present flow. Revision of the structure is considered out of the question at this point and although alternate solutions are available, they do impose some inconveniences in the use of the parking facility.

2. The other project is the First National Bank Drive-In Parking Facility now in the advanced planning stage and planned around the existing traffic pattern on 1st Avenue South. Bank officials indicate that reversing direction of flow on 1st Avenue South would be incompatible with their building plans.

Although these problems are considered serious, the overall efficiency of the traffic operations in the Central Business District is considered of higher priority than the inconveniences that may be caused to individual interests.

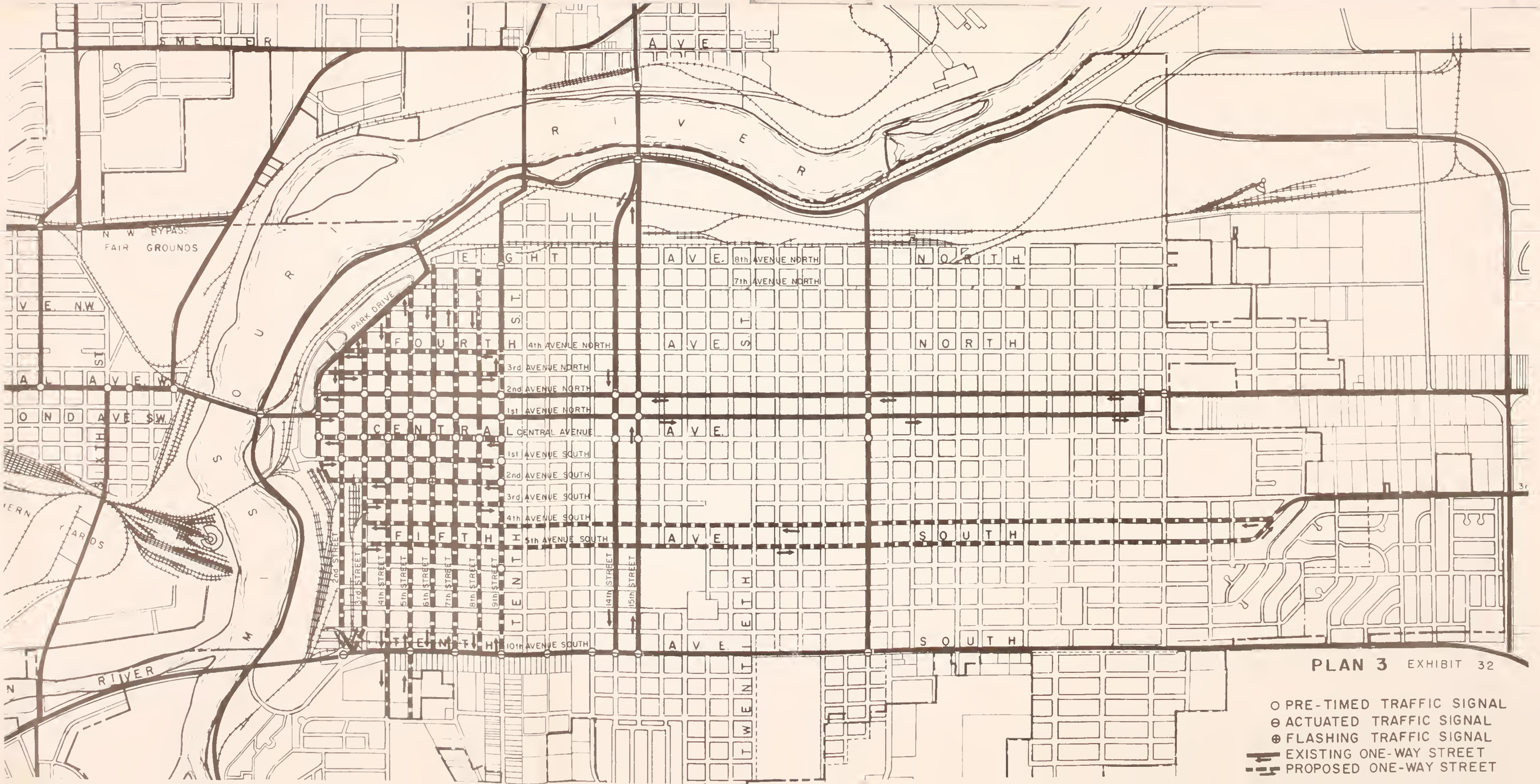
Each of the plans considered provides considerable improvement in the traffic operations. Plans 1 and 3 have the decided advantage of providing progressive offset signal design on all streets, allowing for double left-turns at all intersections, providing for uniform circulation throughout the entire grid area, and eliminating all left-turn conflicts. Plan 2, on the other hand, although providing greatly improved traffic operations, does have some reduced efficiency over Plans 1 and 3. Because of the problems involved with Sears and the 1st National Bank building programs along with the reversal of flow on the 1st and 2nd Avenues North couplet, the City has approved Plan 2. Following this action, the State Highway Commission also has approved Plan 2.

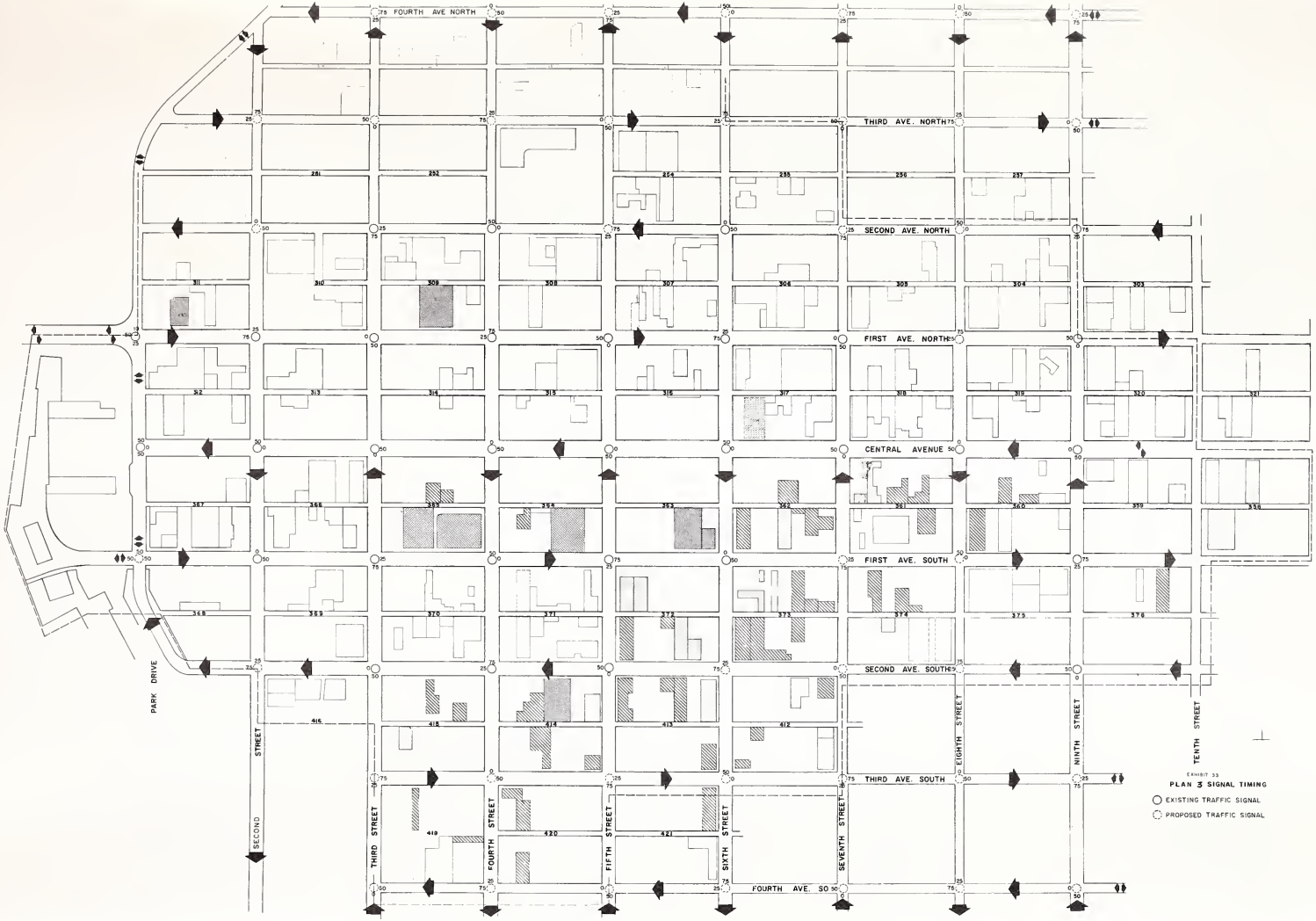
All of these plans guarantee obvious improvement throughout the Central Business District. There should be a noticeable decrease in the number of traffic accidents and the public would find it much easier to circulate throughout the business district without the congestion and delays now evident during peak-hour traffic periods.

Since the major cost of the grid proposals involves major reconstruction of the entire signal system, all plans considered will require approximately the same amount of capital cost, which is estimated to be $334,200.00.

This cost includes all signal work, respacing of parking meters, all painting, signing and pavement marking.

In justifying the recommendation for conversion to some form of expanded one-way grid system in the Central Business District, a number of items was considered.


SMELTER
AVE.
RIVER
N W BYPASS
FAIR GROUNDS
PARK DRIVE
EIGHTH AVE. 8th AVENUE NORTH
7th AVENUE NORTH
NORTH
FOURTH ST.
FOURTH AVE. 4th AVENUE NORTH
NORTH
3rd AVENUE NORTH
2nd AVENUE NORTH
1st AVENUE NORTH
CENTRAL CENTRAL AVENUE
AVE.
1st AVENUE SOUTH
2nd AVENUE SOUTH
3rd AVENUE SOUTH
4th AVENUE SOUTH
FIFTH ST. 5th AVENUE SOUTH
AVE.
SOUTH
TENTH AVE. 10th AVENUE SOUTH
SOUTH
TWENTY
2nd STREET
3rd STREET
4th STREET
5th STREET
6th STREET
7th STREET
8th STREET
9th STREET
14th STREET
15th STREET
RIVER
PLAN 3 EXHIBIT 32
PRE-TIMED TRAFFIC SIGNAL
ACTUATED TRAFFIC SIGNAL
FLASHING TRAFFIC SIGNAL
EXISTING ONE-WAY STREET
PROPOSED ONE-WAY STREET


FOURTH AVE NORTH
THIRD AVE. NORTH
SECOND AVE. NORTH
FIRST AVE. NORTH
CENTRAL AVENUE
FIRST AVE. SOUTH
SECOND AVE. SOUTH
THIRD AVE. SOUTH
FOURTH AVE. SO
PARK DRIVE
SECOND STREET
THIRD STREET
FOURTH STREET
FIFTH STREET
SIXTH STREET
SEVENTH STREET
EIGHTH STREET
NINTH STREET
TENTH STREET
EXHIBIT 33
PLAN 3 SIGNAL TIMING
EXISTING TRAFFIC SIGNAL
PROPOSED TRAFFIC SIGNAL

First, the existing signal system is antiquated and in need of replacement. Most equipment has been in service for 20 years or more and is well below minimal standards. Of 30 signals in the Central Business District, only three are not substandard in some respect, as shown in the following table.

TABLE NO. 7

CENTRAL BUSINESS DISTRICT SUBSTANDARD SIGNALS

	Location	Substandard As To: No. Heads	Location of Heads	Operation	Pedestrian Protection
1.	2nd N. & 3rd St.	x	x	x	x
2.	2nd N. & 4th St.	x	x	x	x
3.	2nd N. & 6th St.		x	x	x
4.	2nd N. & 9th St.		x	x	x
5.	1st N. & Park Dr.				x
6.	1st N. & 2nd St.				x
7.	1st N. & 3rd St.			x	x
8.	1st N. & 4th St.			x	x
9.	1st N. & 5th St.			x	x
10.	1st N. & 6th St.	x	x	x	x
11.	1st N. & 7th St.	x	x	x	x
12.	1st N. & 9th St.		x	x	x
13.	Cent. & Park Dr.	x	x	x	x
14.	Cent. & 2nd St.			x	x
15.	Cent. & 3rd St.		NLT	Lane Control	
16.	Cent. & 4th St.		NLT	Lane Control	
17.	Cent. & 5th St.				
18.	Cent. & 6th St.				
19.	Cent. & 7th St.				
20.	Cent. & 8th St.	x	x	x	x
21.	Cent. & 9th St.	x	x		x
22.	1st S. & 2nd St.		x	x	x
23.	1st S. & 3rd St.		x	x	x
24.	1st S. & 4th St.			x	x
25.	1st S. & 5th St.			x	x
26.	1st S. & 6th St.	x	x	x	x
27.	1st S. & 9th St.	x	x	x	x
28.	2nd S. & 4th St.	x	x	x	x
29.	2nd S. & 5th St.	x	x	x	x
30.	2nd S. & 9th St.	x	x	x	x

Upgrading of the signal system is considered a must and prior to undertaking such a project, a plan of overall improvement must be considered to prevent costly replacement or revision at a later date.

Next, the matter of congestion and capacity was considered. There are nine intersections within the Central Business District now operating near Level of Service "E." These are:

		Approach	V/C
1.	Park Drive & 1st Ave. N.	South	.67
2.	1st Ave. N. & 4th St.	West	.74
3.	1st Ave. N. & 5th St.	West	.80
4.	1st Ave. N. & 7th St.	West	.73
5.	1st Ave. N. & 9th St.	West	.79
6.	Central & Park Drive	South	.87
7.	Central & 2nd St.	East	.77
8.	Central & 3rd St.	West	.78
9.	1st Ave. S. & 2nd St.	South	.80

Temporary relief and improved capacity could be attained at some locations by further restricting parking at intersection approaches. Although this may relieve to some degree the current problem, projected demand for both street capacity and terminal facilities throughout the Central Business District would indicate this to be an unacceptable stop-gap measure.

The matter of accidents was next considered. Of the top twenty accident intersections within the Study Area, eight are located within the Central Business District. In addition, of the top ten accident rate sections, seven are in the area recommended for conversion to a one-way grid system. The reader is referred to Table 2 on Page 23 for statistics on the top twenty accident intersections and to the following table for statistics on the top ten accident rate sections.

TABLE NO. 8

TOP TEN ACCIDENT RATE SECTIONS

Volume	Rating	Location	Rate per Ten Million Miles
900	1	5th Ave. S. - 2nd to 5th St.	761.03
8,800	2	Cent. Ave. - Park Dr. to 5th St.	732.93
2,600	3	2nd Ave. S. - 9th to 15th St.	578.09
500	4	20th St. - 8th Ave. N. to Cent. Ave.	541.18
1,300	5	20th St. - Cent. Ave. to 10th Ave. S.	495.35
11,500	6	Cent. Ave. - 5th to 9th St.	441.73
1,200	7	5th Ave. S. - 9th to 15th St.	412.22
3,800	8	2nd Ave. S. - 2nd to 5th St.	400.55
10,800	9	1st Ave. N. - Park Dr. to 5th St.	364.62
1,100	10	5th Ave. S. - 5th to 9th St.	363.22

The Central Business District is the largest generator of vehicle trips within the Study Area. There was a large increase in the number of trips per day attracted to the Central Business District between 1961 and 1968 (from 18,687 in 1961 to 30,890 in 1968*). This trend is expected to continue at a somewhat less accelerated pace. There can be little doubt that as the community grows, so will the demand for improved traffic operations in the Central Business District. A plan whereby additional one-way systems can be integrated into the network on a staged program will provide a means to greatly improve the total traffic operations program. Considerable increases in capacity, reduction of accidents, better circulation and progressive signal timing all can be accomplished with the recommended one-way grid system.

TELEMETERING INTERCONNECT SYSTEM:

In conjunction with the Central Business District one-way grid proposal and the rebuilding of the signal system, it is recommended that a Central Master Control System be constructed for interconnecting all signals within the Study Area. The proposed type of interconnection will be accomplished through the use of leased Telephone Company cable pairs throughout the system. To institute such a program, it will be necessary to prepare an agreement between the City and the Telephone Company outlining the responsibilities of

* Great Falls Transportation Plan Update, Page 24.

each for the initial capital investment and the continued maintenance and expansion of the system. See attached recommended agreements. The system to be composed of three major elements, including:

1. The System Master;
2. The Interconnect Equipment; and
3. The Intersection Receiver Equipment.

The system master consists of a master controller, a master program drum or time switch, and one or more transmitters or encoders. The master receives and stores traffic volume data from sample detectors within the area, computes and compares the input information and establishes from this information the proper background cycle and also establishes system offset, split, dial transfer, etc. The master time switch in addition provides additional functions as programed.

The transmitters or encoders, as directed by the master controllers, encodes and transmits the proper program to the local intersection equipment. The interconnect equipment consists of cable pairs supplied by the Telephone Company that will connect the master controller to each signalized intersection within the Study Area. The receiver equipment receives and decodes the transmitted master information for use at each of the signalized intersections throughout the area. The extent to which this information is used depends upon the equipment and the functions required at each respective signalized intersection.

The following are considered to be the advantages of a master control interconnect system:

1. Flexibility - System can be expanded both as related to programs available and terminals connected to the system at any time.

2. Reliability - This type of equipment is very reliable as to operation over a period of years.

3. Ease of Installation - New terminal connections do not require costly underground work, by the City as buried cable today does. Telephone Company furnishes all terminal connections between master and intersection control equipment.

4. Costs - Installation and rental rates for leased telephone lines are cheaper per year than the cost of maintaining a City-owned underground cable system. This is due to the fact that the City has no maintenance costs for a leased telephone line system.

Cost estimate to install a master control telephone system and interconnect 68 existing traffic signals to the system through the use of leased telephone lines is as follows:

Master Controller	$ 6,000
68 Telephone Drops at $5 each	340
68 Intersection Receivers at $700	47,600
Total Capital Costs	$53,940
Yearly Rental Costs (Rental costs based on 1/2 mile between terminals at $1.00 per 1/4 mile per month)	$ 1,632

Cost comparison studies made throughout the country, comparing the three methods of interconnection -- radio, buried cable and leased Telephone Company pairs -- indicated the latter should be recommended for this system, based on initial capital equipment costs, yearly operating and maintenance costs and reliability. See the attached graphs showing these cost comparisons. Graphs assume an initial installation of 250 intersections expanded to 1,000. However, costs are comparable to any size of a system. It should also be noted that due to a very rapid change in computerized master control systems, specifically designed for use in the field of traffic control, the type of master and intersection receiver equipment called for in this report is for estimating purposes only. This also included the operational characteristic of the system as a whole. Reevaluation will be required when funds become available. The means by which the master is connected to the intersection equipment does not change. Telephone interconnect cable can be adapted to any type of equipment.

A schematic drawing of the telemetry interconnect is shown in Exhibit No. 34, Page 90.

Whenever possible, the City shall notify the Telephone Company at the beginning of each year of anticipated new installations during the year so that the Telephone Company can program additional central office equipment and circuit requirements in advance.

At least two weeks' notice shall be given to the Telephone Company when service for a new intersection or change in existing service is required. No advance notice is required for a disconnection providing the circuit has been in operation for one month.

The Telephone Company shall bill the City monthly for circuits, installation charges, and any other facilities provided at the request of the City and County of Great Falls in accordance with standard tariff rates. Interchange mileage is the airline distance, determined in quarter-mile multiples (fractional quarter miles being considered as full quarter miles) measured directly between signal lights, so as to produce the lowest intraexchange mileage charge. Under present tariff provisions the cost shall not exceed $_____ per quarter mile. For each additional installation there shall be an installation charge and a monthly billing increase in accordance with the mileage tariff.

The initial cost for installing one cable pair to each of the ____ intersections will be $_____ per intersection.

The initial ____ intersections will be put into operation on or before _____, and billing for the system will begin on the date the system is put into operation. For each additional installation added to the system, billing will begin when it is placed in operation.

All circuits shall be classified and identified as "special service circuits," and 24-hour maintenance service will be provided by the Telephone Company.

MOUNTAIN STATES TELEPHONE COMPANY

BY_____

ATTEST_____

CITY OF GREAT FALLS

BY_____

ATTEST_____

EXHIBIT 34

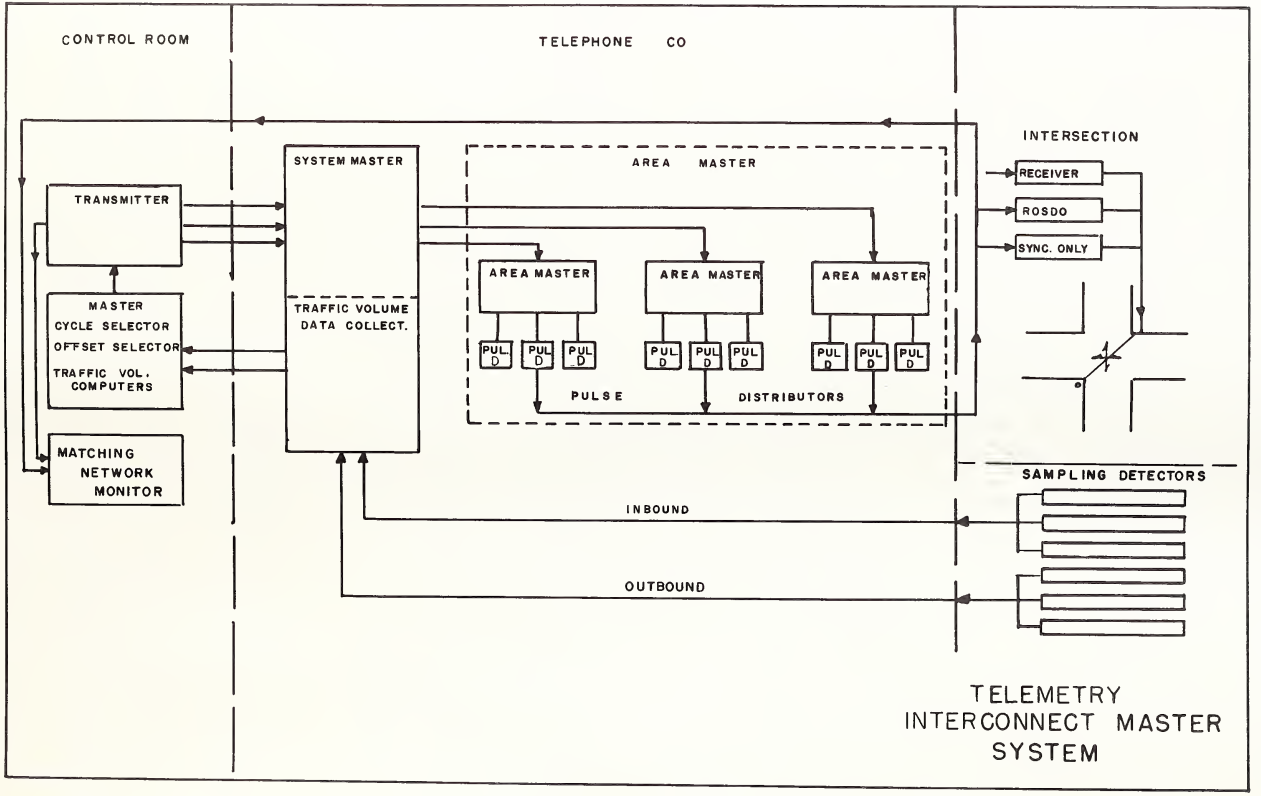

CONTROL ROOM
TELEPHONE CO
TRANSMITTER
MASTER
CYCLE SELECTOR
OFFSET SELECTOR
TRAFFIC VOL. COMPUTERS
MATCHING NETWORK MONITOR
SYSTEM MASTER
TRAFFIC VOLUME DATA COLLECT.
AREA MASTER
AREA MASTER
AREA MASTER
AREA MASTER
PULSE DISTRIBUTORS
INTERSECTION
RECEIVER
ROSDO
SYNC. ONLY
SAMPLING DETECTORS
INBOUND
OUTBOUND
TELEMETRY
INTERCONNECT MASTER
SYSTEM

EXHIBIT 35

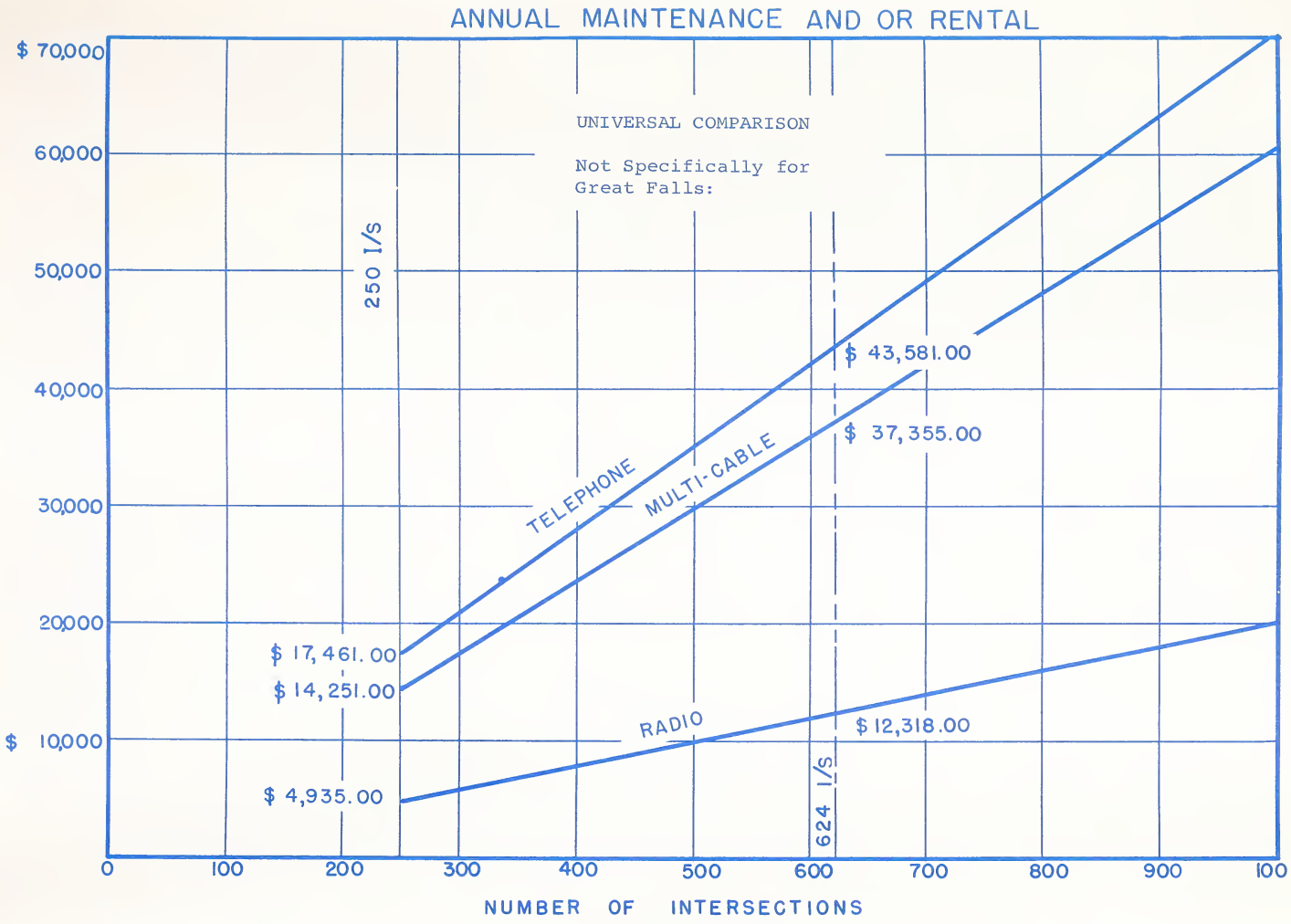
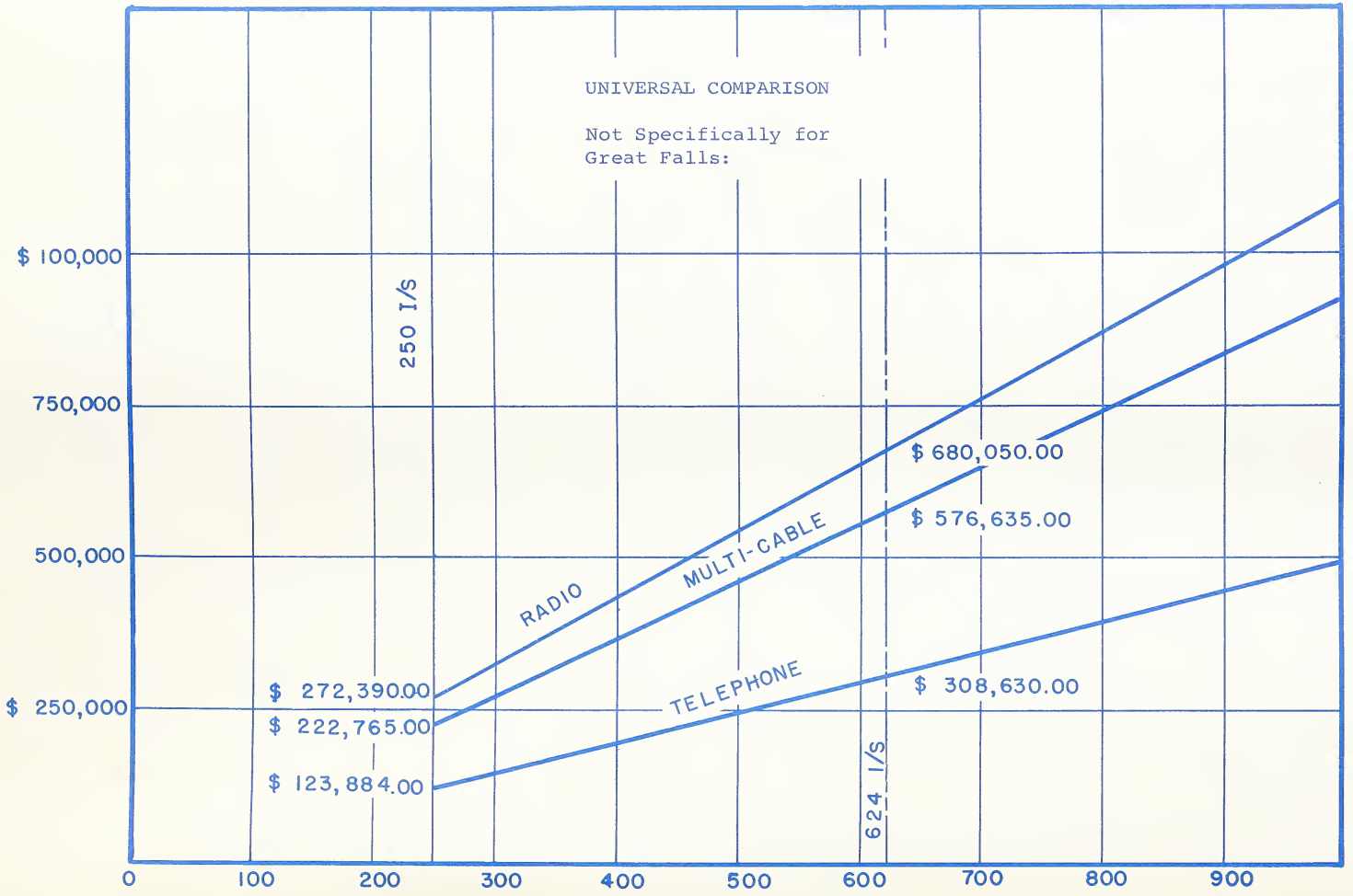

ANNUAL MAINTENANCE AND OR RENTAL
$ 70,000
60,000
50,000
40,000
30,000
20,000
$ 10,000
UNIVERSAL COMPARISON
Not Specifically for
Great Falls:
250 l/s
624 l/s
TELEPHONE
MULTI-CABLE
RADIO
$ 43,581.00
$ 37,355.00
$ 17,461.00
$ 14,251.00
$ 12,318.00
$ 4,935.00
0
100
200
300
400
500
600
700
800
900
100
NUMBER OF INTERSECTIONS

EXHIBIT 36

EQUIPMENT AND INSTALLATION



SAMPLE AGREEMENT FOR TRAFFIC SIGNAL TELEMETERING SERVICE

In accordance with a plan which has previously been worked out between the Mountain States Telephone and Telegraph Company and the City of Great Falls, it is herewith requested that the Telephone Company proceed with the installation as per the following conditions:

The Telephone Company will install and maintain one cable pair to each signalized intersection in the City of Great Falls, as requested by the City. The Telephone Company shall furnish, install, and maintain all required central office equipment.

The maximum overhead run from the Telephone Company's terminal facilities to any specified intersection shall not exceed four spans (approximately 720 feet). In the event facilities are not available at any particular location requested by the City, the Telephone Company shall make every effort to provide such facilities at the earliest possible date. (In the event overhead lines are not available to each of these locations and underground conduit construction is required, the expense shall be borne by the City.)

All circuits will be terminated by the Telephone Company adjacent to the Montana Power Company's traffic signal power source. When the traffic signal power source is located on a wood pole at the intersection, the weatherproof box equipped with a line protector will be installed at this point. When the traffic signal power source is located on a steel pole at the intersection, the weatherproof box and line protector will be installed on a nearby wood pole at the discretion of the Telephone Company.

The Telephone Company will not be involved or concerned with the method used by the City in extending their privately owned circuits. The magnitude and the character of the voltages and currents impressed on the Telephone Company channel by the customer-owned equipment and wiring and the operation and maintenance of such equipment and wiring shall be such as not to interfere with any of the services offered by the Telephone Company or interfere with others.

All circuit terminals shall be stenciled at each intersection by the City for maintenance reference. These numbers shall be furnished the City by the Telephone Company and shall be used by the City when reporting any trouble to the Telephone Company.

TRAFFIC ENGINEERING:

It is evidenced throughout the Study Area that improved traffic engineering techniques and procedures would greatly help the overall development and implementation of an effective traffic operations program. Since a vast majority of the study system falls within the limits of the City of Great Falls, a major portion of the traffic operations program and improvements will be under the direct control and authority of the City of Great Falls. As such, it is recommended that consideration be given to strengthening, upgrading and expanding the traffic engineering department.

It is understood that the City may have great difficulty in providing personnel with the technical background that will be required. However, should this be the case, an allowance should be made in the annual budget to hire on a consulting basis technicians with the background and capabilities of providing guidance on traffic operations improvement. At this point, it would seem reasonable to assume that $10,000 per year could sufficiently employ consulting services to aid the local personnel in the engineering and design of the required improvements. It is herewith suggested that the City Council, along with the administration give serious consideration to incorporate such a program in subsequent budgets and that the Traffic Engineer be allowed to contract for such services as they may be required in the overall development and continued maintenance of the system hardware and other elements of the traffic operation for the community.

In addition to the technical design and programing of improvements, there is an additional need for a more continuous maintenance program, particularly in the field of signing and pavement marking. As now carried out, these operations are considerably substandard and the results are evident throughout the Study Area. The Traffic Engineer must necessarily have at his disposal the necessary manpower and equipment to keep the signing and pavement markings renewed on a continual basis. With a system the size of that included within the Great Falls Study Area, it is very evident that such a program should be a year-around project and specific personnel should be allotted time and equipment to carry out the job effectively. Good pavement markings and a good signing program will pay off in heavy dividends for improved safety and convenience to the travelling public. It is therefore strongly recommended that the local governing body consider the importance of improving the traffic operations and that they do provide within the annual budget sufficient funds to carry out an effective and continuing program.

In analyzing the 1969-1970 Traffic Engineering Budget with the total maintenance and operation portion in the amount of

$39,830, it is apparent that this sum will not meet the requirements of an effective traffic operations program. The budget should be more in the neighborhood of $100,000 for maintenance and operation of the extensive system of signals and other traffic control devices, including pavement markings and until this budget can be expanded to realistic proportions there can be little doubt that the City will continue to receive less than optimum conditions on the operation of its street system. Good traffic operations are universal in the benefits they provide the general public. In the automobile-oriented society of today, and particularly in Great Falls where other forms of mass transit are unavailable, automobile travel is something that affects everyone. Improvements that relieve congestion, increase efficiency, reduce accidents and save time are things that will be noticed by everyone. As a consequence, they will receive wide acceptance by the general public.

TABLE NO. 9

SUMMARY OF "TOPICS" IMPROVEMENTS

	Total	Federal	State	City	
FIRST PRIORITY					
Stage One Improvements	$267,600	$174,470	$ 87,270	$ 5,860	City's contribution includes cost of curb and gutter replacement and incidental work primarily in the form of services, etc.
SECOND PRIORITY					
10th Avenue South					*It is estimated that the recommended lighting system will increase annual maintenance and operation costs $12,000. How this cost is apportioned will be subject to negotiation between the State and local governing body. It is assumed at this time that Highway Commission policy as per action taken in August 1970 will allow State funds to be used for this cost. This will be an annual charge and will continue for the life of the system.
Restriping	6,000		6,000		
*Relighting	12,000		12,000		
	18,000	-0-	18,000	-0-	
THIRD PRIORITY					
Central Bus. District Improve.					**Total Initial Capital Investment is considered a "TOPICS"-eligible item and therefore, 100% funded by Federal and State funds. Annual maintenance of signals, interconnect system, pavement markings, etc. will be a City responsibility and is estimated to cost $27,832 per year.
Signing & Pavement Markings	89,200				
**Signal Improvements	245,000				
**Interconnect System	53,940				
	388,140	258,760	129,380	-0-	
FOURTH PRIORITY					
Stage Two Improvements	180,000	116,670	58,330	5,000	City's contribution includes cost of curb and gutter replacement and incidental work primarily in the form of services, etc.
TOTALS:	$853,740	$549,900	$292,980	$10,860	

MONTANA HIGHWAY COMMISSION

TRAFFIC DEPARTMENT

ACCIDENT ANALYSIS

COLLISION DIAGRAM

CITY OF Gt. Falls COUNTY Cascade

INTERSECTION OF 1st Ave. N. AND Park Drive

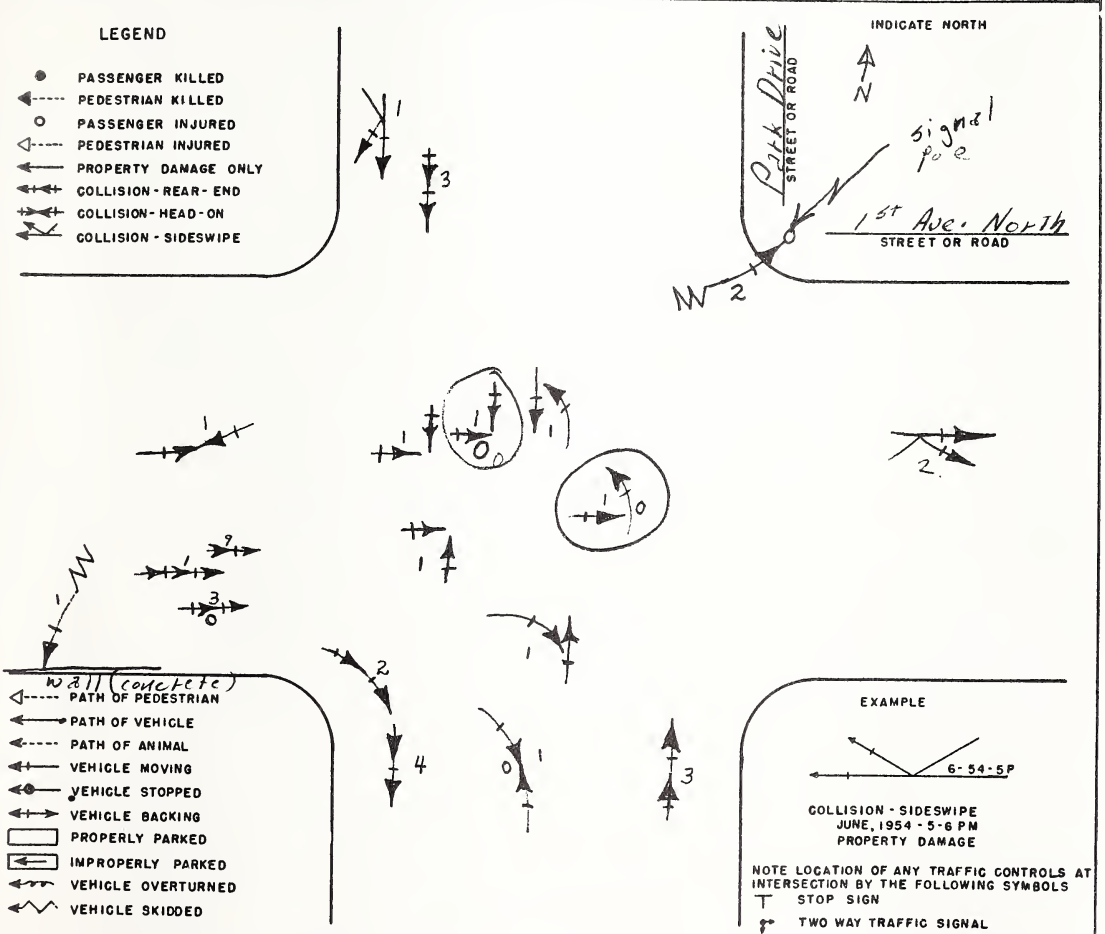
HIGHWAY NUMBER _____

PERIOD COVERED 1966, 1967, 1968

COMPILED BY _____ DRAWN BY Roberts DATE _____

LEGEND

- PASSENGER KILLED
- PEDESTRIAN KILLED
- PASSENGER INJURED
- PEDESTRIAN INJURED
- PROPERTY DAMAGE ONLY
- COLLISION - REAR - END
- COLLISION - HEAD - ON
- COLLISION - SIDESWIPE



- PATH OF PEDESTRIAN
- PATH OF VEHICLE
- PATH OF ANIMAL
- VEHICLE MOVING
- VEHICLE STOPPED
- VEHICLE BACKING
- PROPERLY PARKED
- IMPROPERLY PARKED
- VEHICLE OVERTURNED
- VEHICLE SKIDDED

EXAMPLE

COLLISION - SIDESWIPE
JUNE, 1954 - 5-6 PM
PROPERTY DAMAGE

NOTE LOCATION OF ANY TRAFFIC CONTROLS AT INTERSECTION BY THE FOLLOWING SYMBOLS

- STOP SIGN
- TWO WAY TRAFFIC SIGNAL
- FOUR WAY TRAFFIC SIGNAL

COLLISION TYPE	TOTAL			
	FATAL	INJURY	PROP DAMAGE	TOTAL
ANGLE		1	3	4
HEAD - ON		1		1
REAR - END		3	22	25
SIDESWIPE			2	2
TURNING MOVEMENT		1	2	3
PARKING				
NON - COLLISION				
FIXED OBJECT			4	4
PEDESTRIAN				
BACKING				
MISC.				
TOTAL				39

REMARKS

High number of rear End accidents from the West approach caused be reduced by additional warning signs on the approach and better progression. Sig not timing with Sig at Rivers Rd & 1st Ave No.

Turning Movement & ∠ collisions Could be reduced by providing Spec. phases for the heavy left turn movement from the South approach

MONTANA HIGHWAY COMMISSION

TRAFFIC DEPARTMENT
ACCIDENT ANALYSIS

COLLISION DIAGRAM

CITY OF _____ COUNTY _____

INTERSECTION OF _____ AND _____

HIGHWAY NUMBER _____

PERIOD COVERED _____

COMPILED BY _____ DRAWN BY _____ DATE _____

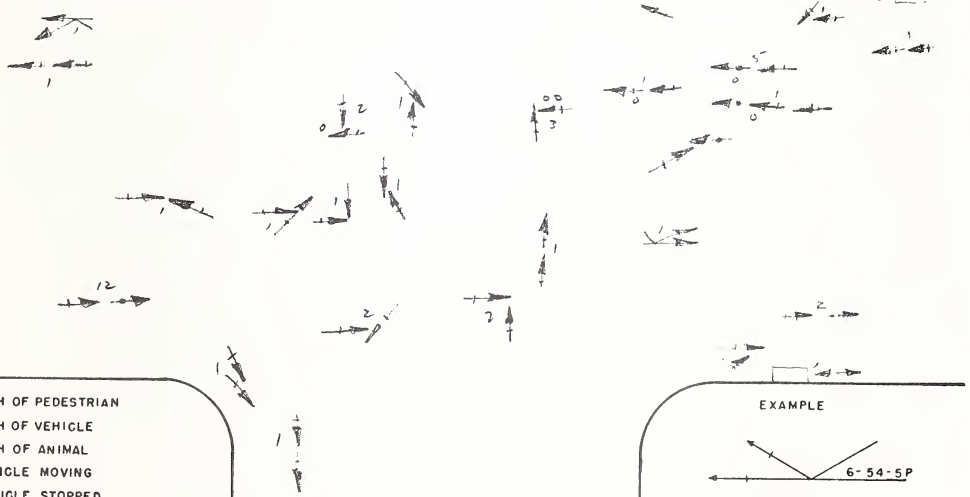
LEGEND

- PASSENGER KILLED
- PEDESTRIAN KILLED
- PASSENGER INJURED
- PEDESTRIAN INJURED
- PROPERTY DAMAGE ONLY
- COLLISION - REAR - END
- COLLISION - HEAD - ON
- COLLISION - SIDESWIPE

INDICATE NORTH

STREET OR ROAD

STREET OR ROAD



- PATH OF PEDESTRIAN
- PATH OF VEHICLE
- PATH OF ANIMAL
- VEHICLE MOVING
- VEHICLE STOPPED
- VEHICLE BACKING
- PROPERLY PARKED
- IMPROPERLY PARKED
- VEHICLE OVERTURNED
- VEHICLE SKIDDED

EXAMPLE

COLLISION - SIDESWIPE
JUNE, 1954 - 5-6 PM
PROPERTY DAMAGE

NOTE LOCATION OF ANY TRAFFIC CONTROLS AT INTERSECTION BY THE FOLLOWING SYMBOLS

- STOP SIGN
- TWO WAY TRAFFIC SIGNAL
- FOUR WAY TRAFFIC SIGNAL

COLLISION TYPE	TOTAL			
	FATAL	INJURY	PROP DAMAGE	TOTAL
ANGLE		2	10	12
HEAD - ON			1	1
REAR - END		3	24	27
SIDESWIPE			2	2
TURNING MOVEMENT			7	7
PARKING				
NON - COLLISION				
FIXED OBJECT				
PEDESTRIAN				
BACKING			2	2
MISC.				
TOTAL		5	46	51

REMARKS

* all four (3 parked - 1 moving) cars

MONTANA HIGHWAY COMMISSION

TRAFFIC DEPARTMENT

ACCIDENT ANALYSIS

COLLISION DIAGRAM

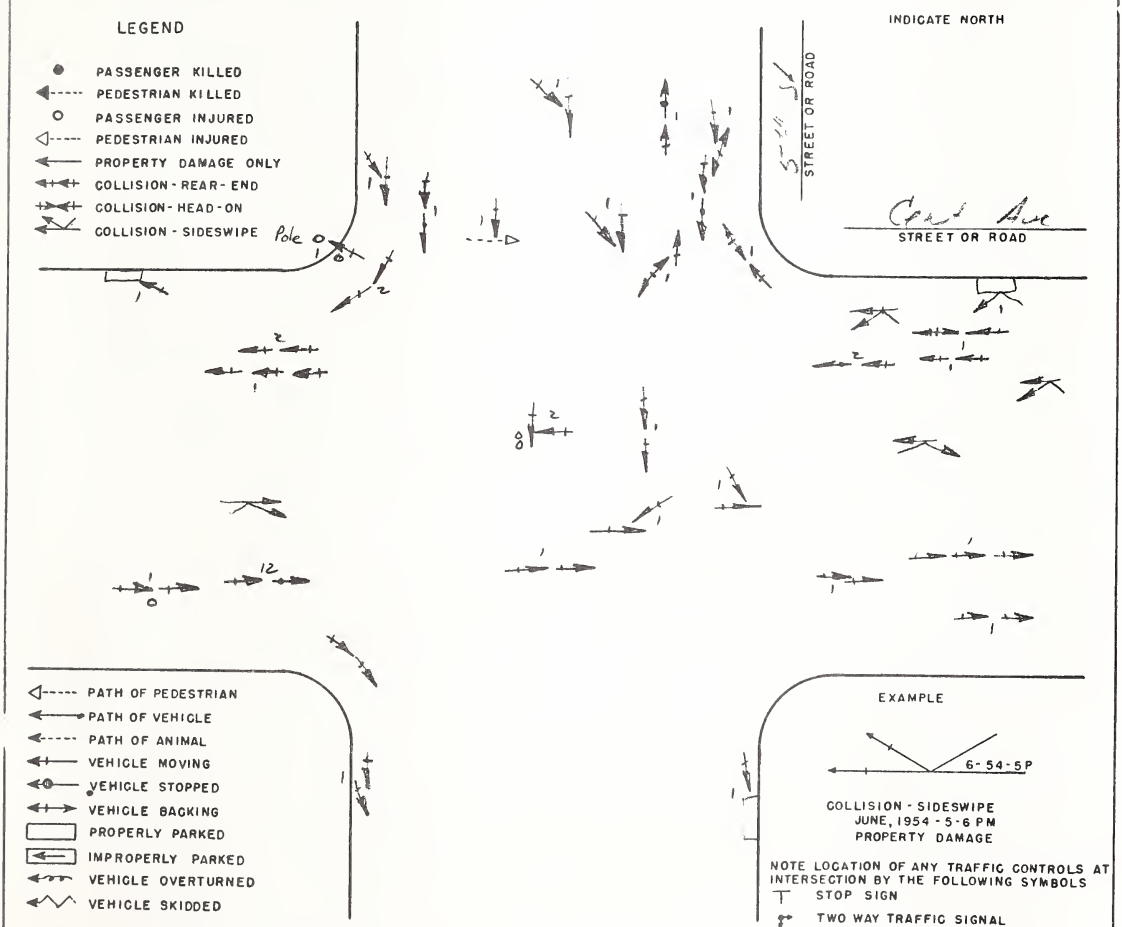
CITY OF Gt Falls COUNTY Cascade

INTERSECTION OF Court AND 5th A

HIGHWAY NUMBER

PERIOD COVERED 66 67 68

COMPILED BY DRAWN BY DATE



COLLISION TYPE	TOTAL			
	FATAL	INJURY	PROP DAMAGE	TOTAL
ANGLE		1	2	3
HEAD - ON				
REAR - END		1	26	27
SIDESWIPE			6	6
TURNING MOVEMENT			7	7
PARKING			3	3
NON - COLLISION				
FIXED OBJECT		1		1
PEDESTRIAN				
BACKING			3	3
MISC.			1	1
TOTAL		3	48	51

REMARKS

pedestrian using cross walk "No" injury

MONTANA HIGHWAY COMMISSION

TRAFFIC DEPARTMENT
ACCIDENT ANALYSIS

COLLISION DIAGRAM

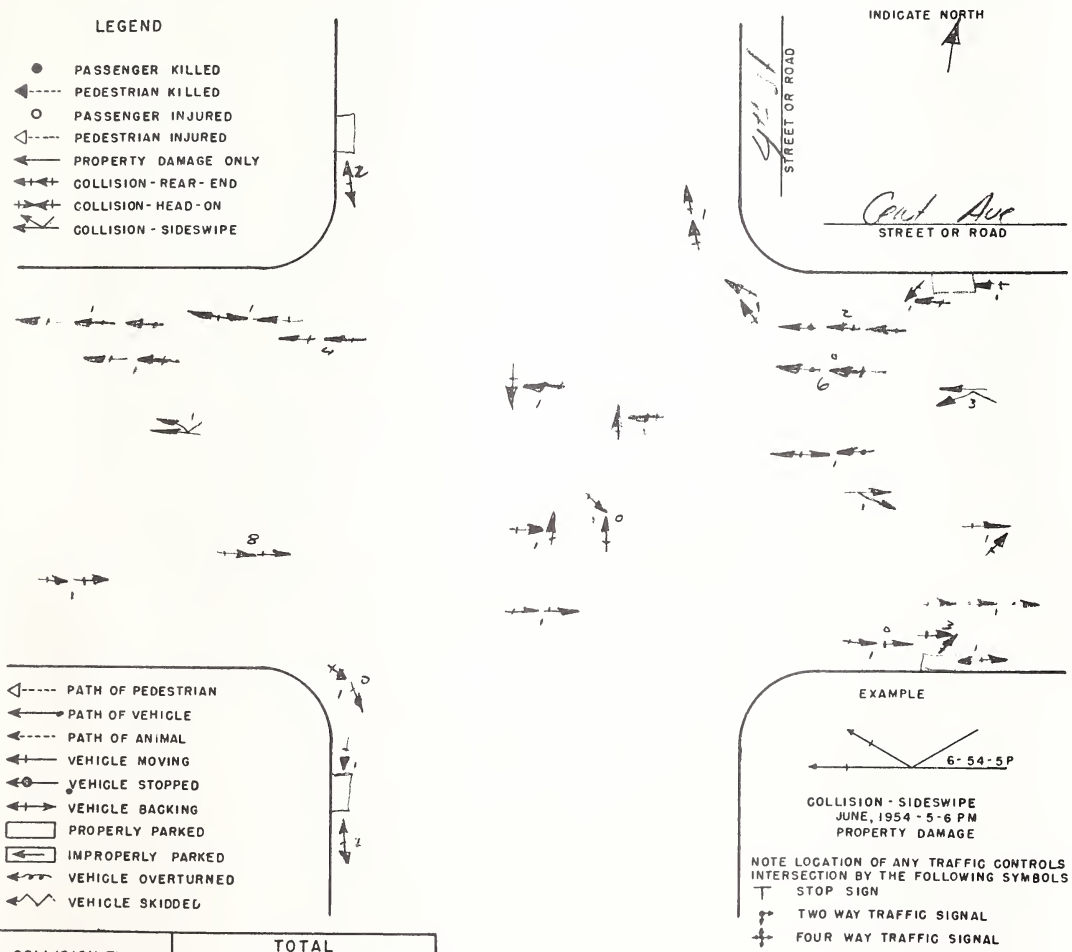
CITY OF G Falls COUNTY Cascade

INTERSECTION OF Cent. Ave. AND 4th St

HIGHWAY NUMBER

PERIOD COVERED 66 67 68

COMPILED BY DRAWN BY DATE



COLLISION TYPE	TOTAL			
	FATAL	INJURY	PROP DAMAGE	TOTAL
ANGLE			8	8
HEAD - ON				
REAR - END		3	23	26
SIDESWIPE			5	5
TURNING MOVEMENT		1	3	4
PARKING			2	2
NON - COLLISION				
FIXED OBJECT				
PEDESTRIAN				
BACKING			7	7
MISC.				
TOTAL		4	38	52

REMARKS

MONTANA HIGHWAY COMMISSION

TRAFFIC DEPARTMENT

ACCIDENT ANALYSIS

COLLISION DIAGRAM

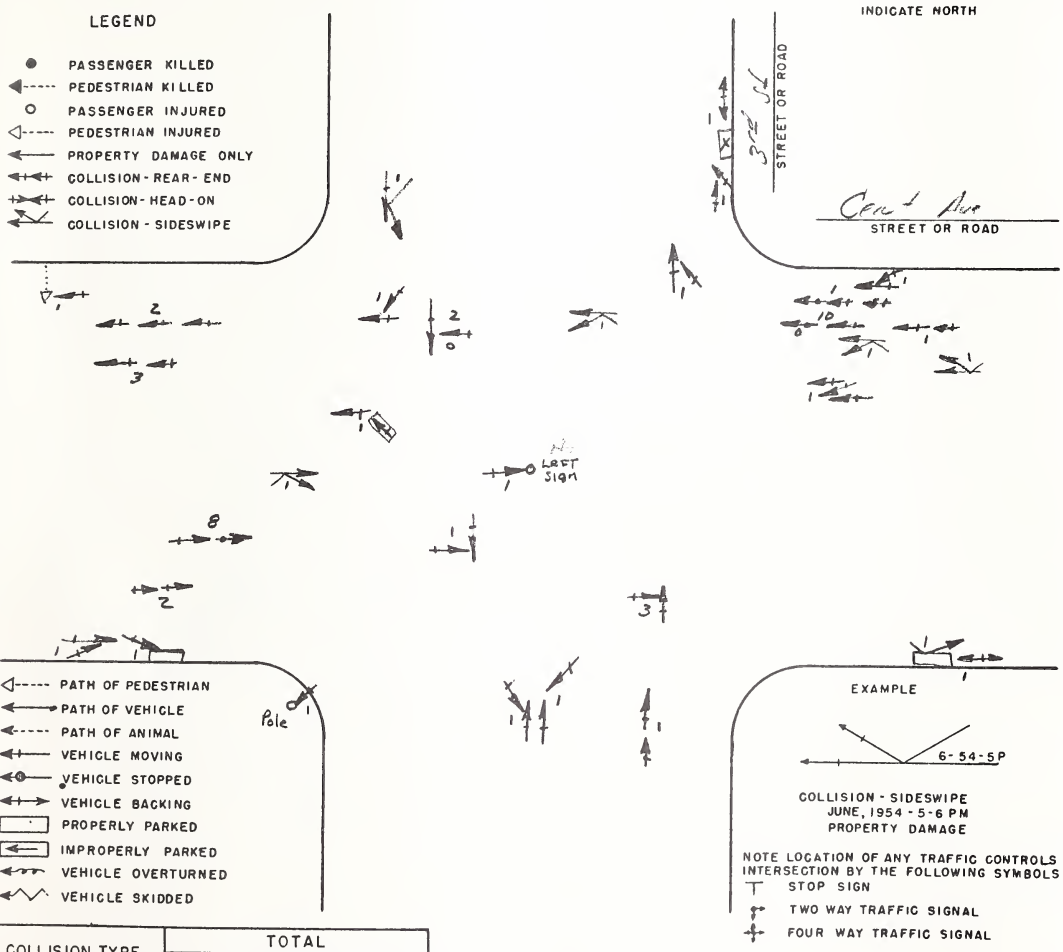
CITY OF Gt. Falls COUNTY Cascade

INTERSECTION OF Central AND 3rd

HIGHWAY NUMBER

PERIOD COVERED 66 67 68

COMPILED BY DRAWN BY DATE



COLLISION TYPE	TOTAL			
	FATAL	INJURY	PROP DAMAGE	TOTAL
ANGLE		1	7	8
HEAD - ON				
REAR - END		1	26	27
SIDESWIPE			4	4
TURNING MOVEMENT			7	7
PARKING			5	5
NON - COLLISION				
FIXED OBJECT			2	2
PEDESTRIAN				
BACKING			1	1
MISC.		1		1
TOTAL		3	52	55

REMARKS

pedestrian crossing in middle of block, man injured.

[X] - cycle [ ] cycle

MONTANA HIGHWAY COMMISSION

TRAFFIC DEPARTMENT

ACCIDENT ANALYSIS

COLLISION DIAGRAM

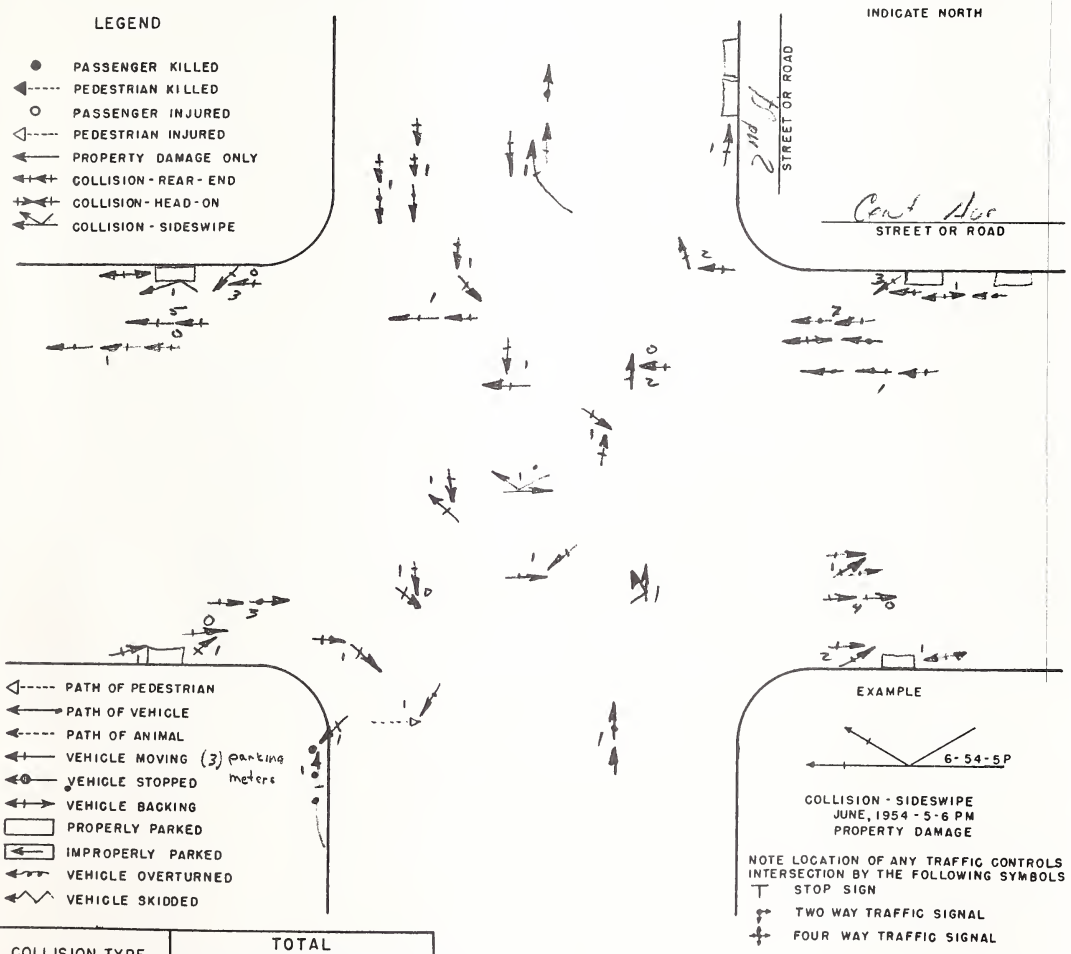
CITY OF Gt Falls COUNTY Cascade

INTERSECTION OF Cent AND 2nd

HIGHWAY NUMBER

PERIOD COVERED 66 67 68

COMPILED BY DRAWN BY DATE



COLLISION TYPE	TOTAL			
	FATAL	INJURY	PROP DAMAGE	TOTAL
ANGLE		4	7	11
HEAD - ON				
REAR - END		2	25	27
SIDESWIPE			1	1
TURNING MOVEMENT			8	8
PARKING			7	7
NON - COLLISION				
FIXED OBJECT			1	1
PEDESTRIAN				
BACKING			3	3
MISC.		1		1
TOTAL		7	52	59

REMARKS

pedestrian going cross walk - was injuried

MONTANA HIGHWAY COMMISSION

TRAFFIC DEPARTMENT
ACCIDENT ANALYSIS

COLLISION DIAGRAM

CITY OF Gt Falls COUNTY Cascade

INTERSECTION OF Central AND 9th

HIGHWAY NUMBER

PERIOD COVERED 66 67 68

COMPILED BY DRAWN BY DATE

LEGEND

- PASSENGER KILLED
- PEDESTRIAN KILLED
- PASSENGER INJURED
- PEDESTRIAN INJURED
- PROPERTY DAMAGE ONLY
- COLLISION - REAR - END
- COLLISION - HEAD - ON
- COLLISION - SIDESWIPE

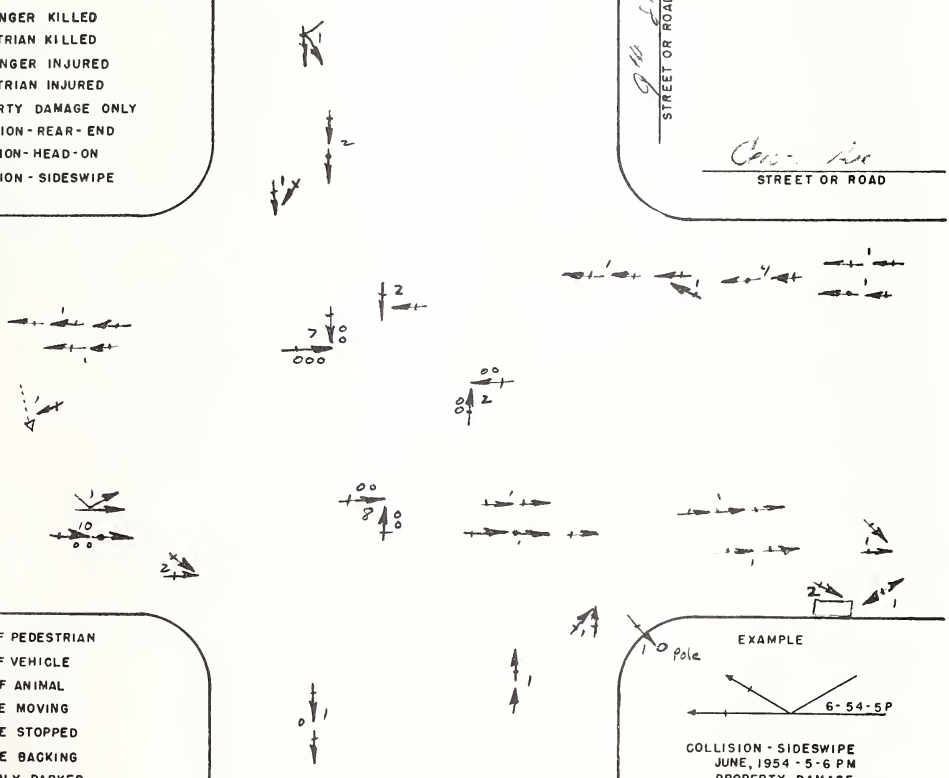
INDICATE NORTH

9th S.

STREET OR ROAD

Central Ave

STREET OR ROAD



- PATH OF PEDESTRIAN
- PATH OF VEHICLE
- PATH OF ANIMAL
- VEHICLE MOVING
- VEHICLE STOPPED
- VEHICLE BACKING
- PROPERLY PARKED
- IMPROPERLY PARKED
- VEHICLE OVERTURNED
- VEHICLE SKIDDED

EXAMPLE

Pole

6-54-5P

COLLISION - SIDESWIPE
JUNE, 1954 - 5-6 P.M.
PROPERTY DAMAGE

NOTE LOCATION OF ANY TRAFFIC CONTROLS AT INTERSECTION BY THE FOLLOWING SYMBOLS

- STOP SIGN
- TWO WAY TRAFFIC SIGNAL
- FOUR WAY TRAFFIC SIGNAL

COLLISION TYPE	TOTAL			
	FATAL	INJURY	PROP DAMAGE	TOTAL
ANGLE		10	10	20
HEAD - ON				
REAR - END		3	24	27
SIDESWIPE			2	2
TURNING MOVEMENT			6	6
PARKING			1	1
NON - COLLISION				
FIXED OBJECT			1	1
PEDESTRIAN				
BACKING			1	1
MISC.		1		1
TOTAL		14	45	59

REMARKS

pedestrian hit crossing in middle of block. he was injuried.

MONTANA HIGHWAY COMMISSION

TRAFFIC DEPARTMENT

ACCIDENT ANALYSIS

COLLISION DIAGRAM

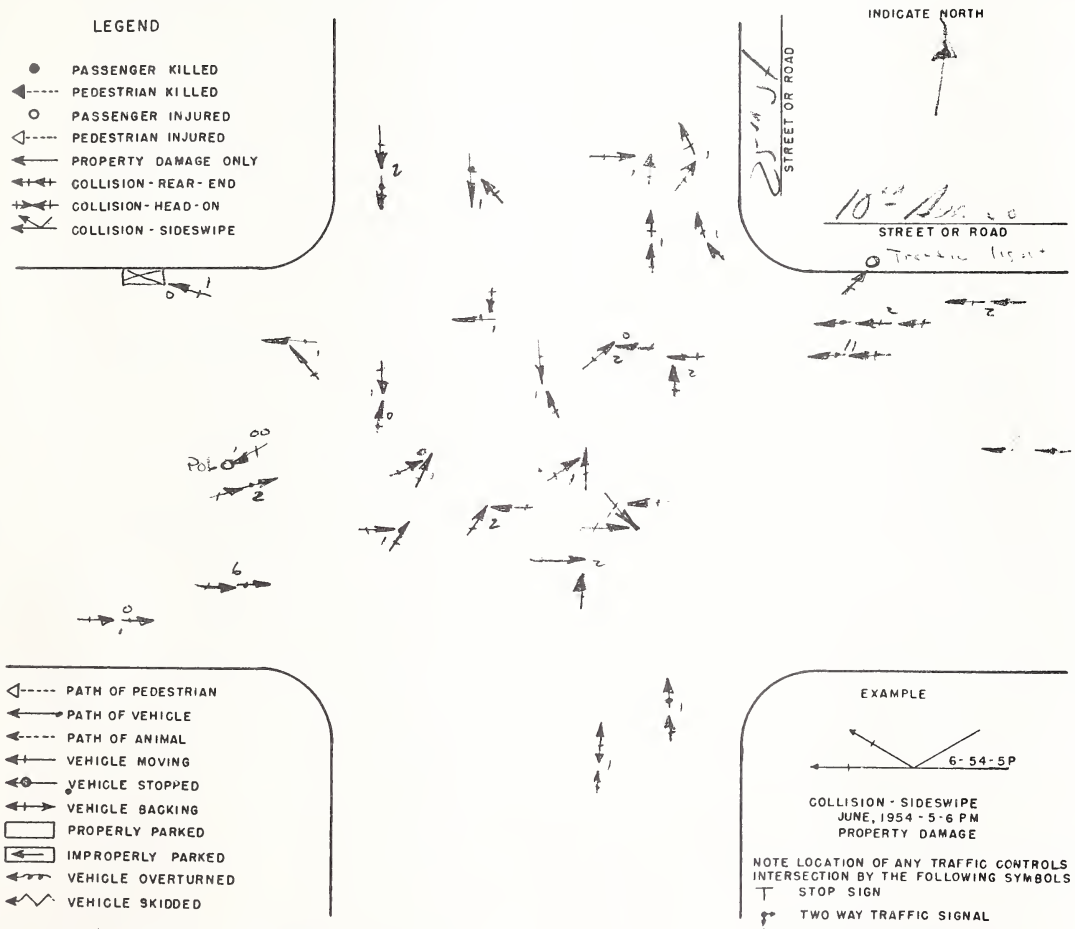
CITY OF GREAT FALLS COUNTY CASCADE

INTERSECTION OF 10TH AVE S AND 25TH ST

HIGHWAY NUMBER

PERIOD COVERED 66 67 68

COMPILED BY DRAWN BY DATE



COLLISION TYPE	TOTAL			
	FATAL	INJURY	PROP DAMAGE	TOTAL
ANGLE			8	8
HEAD - ON		1	1	2
REAR - END		3	27	30
SIDESWIPE				
TURNING MOVEMENT		2	8	10
PARKING				
NON - COLLISION				
FIXED OBJECT		1	1	2
PEDESTRIAN				
BACKING			1	1
MISC.				
TOTAL		7	46	53

REMARKS

MONTANA HIGHWAY COMMISSION

TRAFFIC DEPARTMENT

ACCIDENT ANALYSIS

COLLISION DIAGRAM

CITY OF _____ COUNTY _____

INTERSECTION OF _____ AND _____

HIGHWAY NUMBER _____

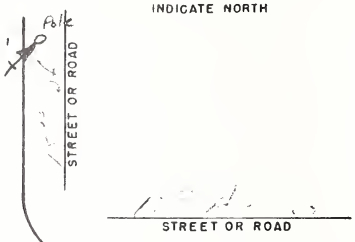
PERIOD COVERED _____

COMPILED BY _____ DRAWN BY _____ DATE _____

LEGEND

- PASSENGER KILLED
- PEDESTRIAN KILLED
- PASSENGER INJURED
- PEDESTRIAN INJURED
- PROPERTY DAMAGE ONLY
- COLLISION - REAR - END
- COLLISION - HEAD - ON
- COLLISION - SIDESWIPE

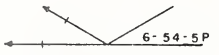
INDICATE NORTH





- PATH OF PEDESTRIAN
- PATH OF VEHICLE
- PATH OF ANIMAL
- VEHICLE MOVING
- VEHICLE STOPPED
- VEHICLE BACKING
- PROPERLY PARKED
- IMPROPERLY PARKED
- VEHICLE OVERTURNED
- VEHICLE SKIDDED

EXAMPLE



COLLISION - SIDESWIPE
JUNE, 1954 - 5-6 PM
PROPERTY DAMAGE

NOTE LOCATION OF ANY TRAFFIC CONTROLS AT INTERSECTION BY THE FOLLOWING SYMBOLS

- STOP SIGN
- TWO WAY TRAFFIC SIGNAL
- FOUR WAY TRAFFIC SIGNAL

COLLISION TYPE	TOTAL			
	FATAL	INJURY	PROP DAMAGE	TOTAL
ANGLE		1	5	6
HEAD - ON				
REAR - END		6	25	31
SIDESWIPE			1	1
TURNING MOVEMENT		1	1	2
PARKING				
NON - COLLISION				
FIXED OBJECT		3	2	5
PEDESTRIAN				
BACKING			2	2
MISC.				
TOTAL		11	36	47

REMARKS _____

MONTANA HIGHWAY COMMISSION

TRAFFIC DEPARTMENT

ACCIDENT ANALYSIS

COLLISION DIAGRAM

CITY OF Gt Falls COUNTY Cascade

INTERSECTION OF 10th Ave So AND 14th St

HIGHWAY NUMBER

PERIOD COVERED 66 67 68

COMPILED BY DRAWN BY DATE

LEGEND

- PASSENGER KILLED
- PEDESTRIAN KILLED
- PASSENGER INJURED
- PEDESTRIAN INJURED
- PROPERTY DAMAGE ONLY
- COLLISION - REAR - END
- COLLISION - HEAD - ON
- COLLISION - SIDESWIPE

INDICATE NORTH

14th St
STREET OR ROAD

10th Ave So
STREET OR ROAD



- PATH OF PEDESTRIAN
- PATH OF VEHICLE
- PATH OF ANIMAL
- VEHICLE MOVING
- VEHICLE STOPPED
- VEHICLE BACKING
- PROPERLY PARKED
- IMPROPERLY PARKED
- VEHICLE OVERTURNED
- VEHICLE SKIDDED

EXAMPLE

COLLISION - SIDESWIPE
JUNE, 1954 - 5-6 PM
PROPERTY DAMAGE

NOTE LOCATION OF ANY TRAFFIC CONTROLS AT INTERSECTION BY THE FOLLOWING SYMBOLS

- STOP SIGN
- TWO WAY TRAFFIC SIGNAL
- FOUR WAY TRAFFIC SIGNAL

COLLISION TYPE	TOTAL			
	FATAL	INJURY	PROP DAMAGE	TOTAL
ANGLE			18	18
HEAD - ON				
REAR - END		7	28	35
SIDESWIPE			1	1
TURNING MOVEMENT		2	5	7
PARKING				
NON - COLLISION				
FIXED OBJECT			2	2
PEDESTRIAN				
BACKING			2	2
MISC.				
TOTAL		9	56	65

REMARKS

In accident involving pedestrian was riding a bicycle. Two ... injuries

MONTANA HIGHWAY COMMISSION

TRAFFIC DEPARTMENT

ACCIDENT ANALYSIS

COLLISION DIAGRAM

CITY OF _____ COUNTY _____

INTERSECTION OF 10th Ave. So AND _____

HIGHWAY NUMBER _____

PERIOD COVERED _____

COMPILED BY _____ DRAWN BY _____ DATE _____

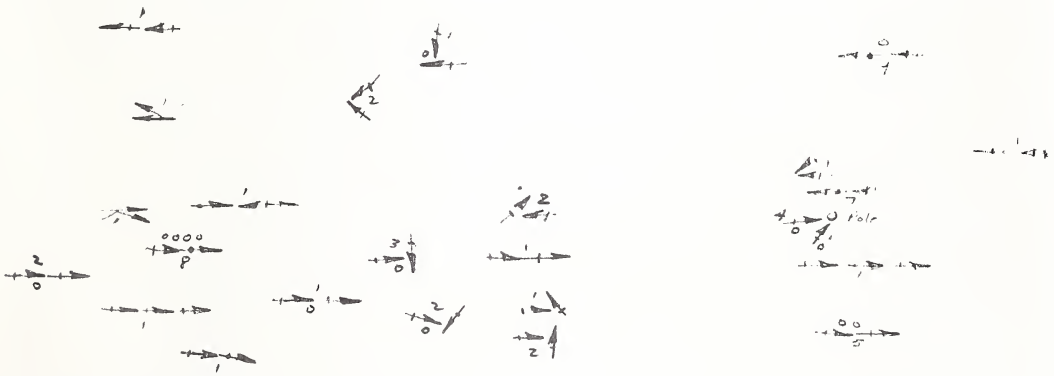
LEGEND

- PASSENGER KILLED
- PEDESTRIAN KILLED
- PASSENGER INJURED
- PEDESTRIAN INJURED
- PROPERTY DAMAGE ONLY
- COLLISION - REAR - END
- COLLISION - HEAD - ON
- COLLISION - SIDESWIPE

INDICATE NORTH

STREET OR ROAD

STREET OR ROAD



- PATH OF PEDESTRIAN
- PATH OF VEHICLE
- PATH OF ANIMAL
- VEHICLE MOVING
- VEHICLE STOPPED
- VEHICLE BACKING
- PROPERLY PARKED
- IMPROPERLY PARKED
- VEHICLE OVERTURNED
- VEHICLE SKIDDED

EXAMPLE

6-54-5P

COLLISION - SIDESWIPE
JUNE, 1954 - 5-6 PM
PROPERTY DAMAGE

NOTE LOCATION OF ANY TRAFFIC CONTROLS AT INTERSECTION BY THE FOLLOWING SYMBOLS

- STOP SIGN
- TWO WAY TRAFFIC SIGNAL
- FOUR WAY TRAFFIC SIGNAL

COLLISION TYPE	TOTAL			
	FATAL	INJURY	PROP DAMAGE	TOTAL
ANGLE		2	5	7
HEAD - ON				
REAR - END		9	33	42
SIDESWIPE			2	2
TURNING MOVEMENT		1	6	7
PARKING				
NON - COLLISION				
FIXED OBJECT		2	4	6
PEDESTRIAN				
BACKING			1	1
MISC.				
TOTAL		14	51	65

REMARKS _____

MONTANA HIGHWAY COMMISSION

TRAFFIC DEPARTMENT

ACCIDENT ANALYSIS

COLLISION DIAGRAM

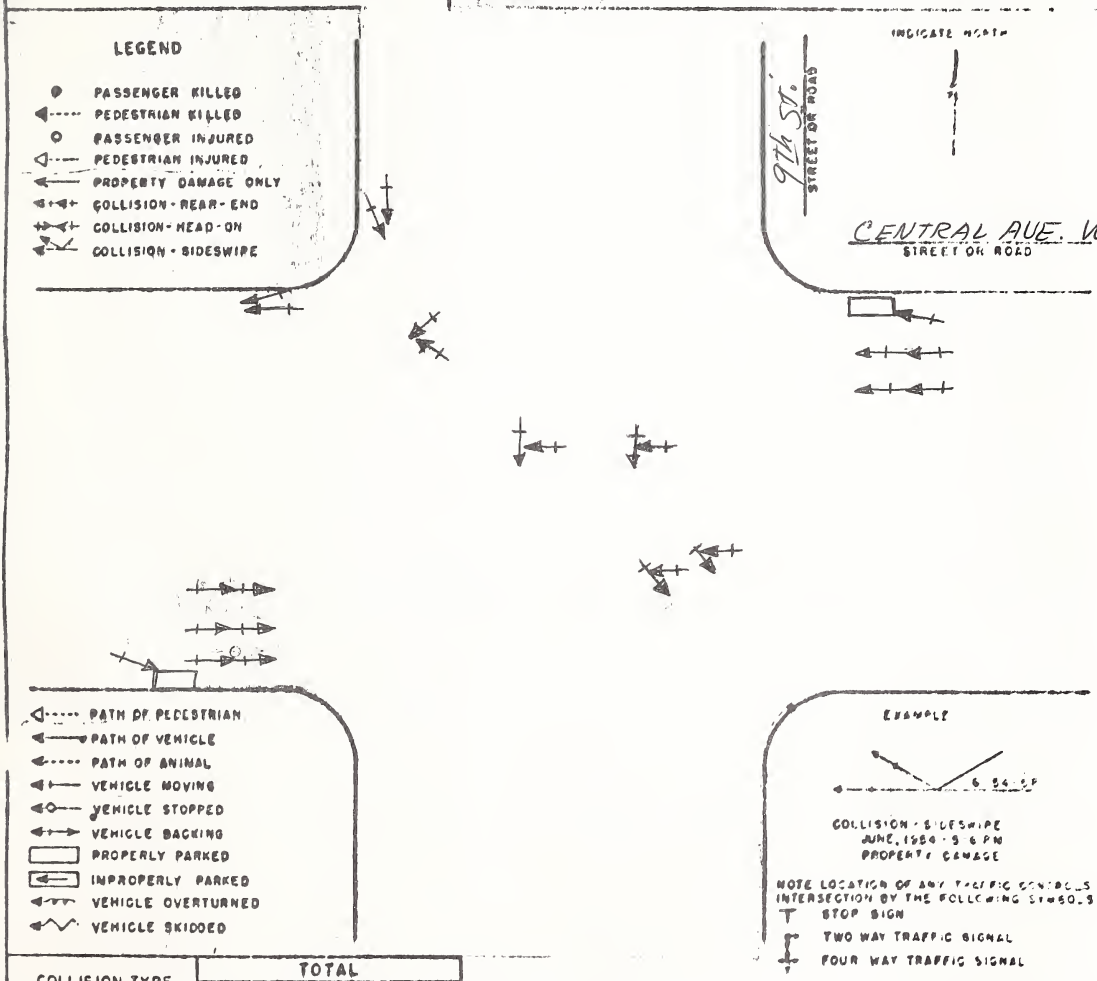
CITY OF GREAT FALLS COUNTY CASCADE

INTERSECTION CENTRAL AVE W AND 9th ST.

HIGHWAY NUMBER

PERIOD COVERED 1969, 1970 FIRST half, 1971

COMPILED BY _____ DRAWN BY _____ DATE _____



COLLISION TYPE	TOTAL			
	FATAL	INJURY	PROP DAMAGE	TOTAL
ANGLE			2	2
HEAD - ON				
REAR END			5	5
SIDESWIPE				
TURNING MOVEMENT		1	2	3
PARKING			2	2
NON-COLLISION				
FIXED OBJECT			2	2
PEDESTRIAN				
BACKING				
MISC				
TOTAL		1	13	14

REMARKS _____

MONTANA HIGHWAY COMMISSION

TRAFFIC DEPARTMENT

ACCIDENT ANALYSIS

COLLISION DIAGRAM

CITY OF GREAT FALLS COUNTY Cascade

INTERSECTION Smelter Ave AND 4th St.

HIGHWAY NUMBER

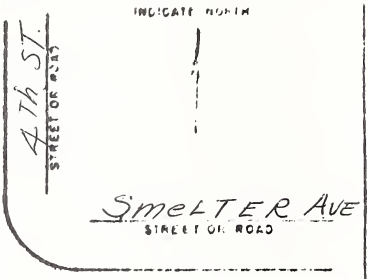
PERIOD COVERED 1969 - 1970 - First half 1971

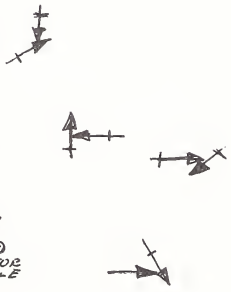
COMPILED BY DRAWN BY DATE

LEGEND

- PASSENGER KILLED
- PEDESTRIAN KILLED
- PASSENGER INJURED
- PEDESTRIAN INJURED
- PROPERTY DAMAGE ONLY
- COLLISION - REAR - END
- COLLISION - HEAD - ON
- COLLISION - SIDESWIPE









- PATH OF PEDESTRIAN
- PATH OF VEHICLE
- PATH OF ANIMAL
- VEHICLE MOVING
- VEHICLE STOPPED
- VEHICLE BACKING
- PROPERLY PARKED
- IMPROPERLY PARKED
- VEHICLE OVERTURNED
- VEHICLE SKIDDED



EXAMPLE



COLLISION - SIDESWIPE
JUNE, 1954 - 5 6 PM
PROPERTY DAMAGE

NOTE LOCATION OF ANY TRAFFIC CONTROLS AT INTERSECTION BY THE FOLLOWING SYMBOLS

- STOP SIGN
- TWO WAY TRAFFIC SIGNAL
- FOUR WAY TRAFFIC SIGNAL

COLLISION TYPE	TOTAL			
	FATAL	INJURY	PROP DAMAGE	TOTAL
ANGLE			1	1
HEAD - ON				
REAR - END		1	5	6
SIDESWIPE				
TURNING MOVEMENT			3	3
PARKING				
NON - COLLISION				
FIXED OBJECT				
PEDESTRIAN				
BACKING				
MISC			1	1
TOTAL		1	10	11

REMARKS

MONTANA HIGHWAY COMMISSION

TRAFFIC DEPARTMENT

ACCIDENT ANALYSIS

COLLISION DIAGRAM

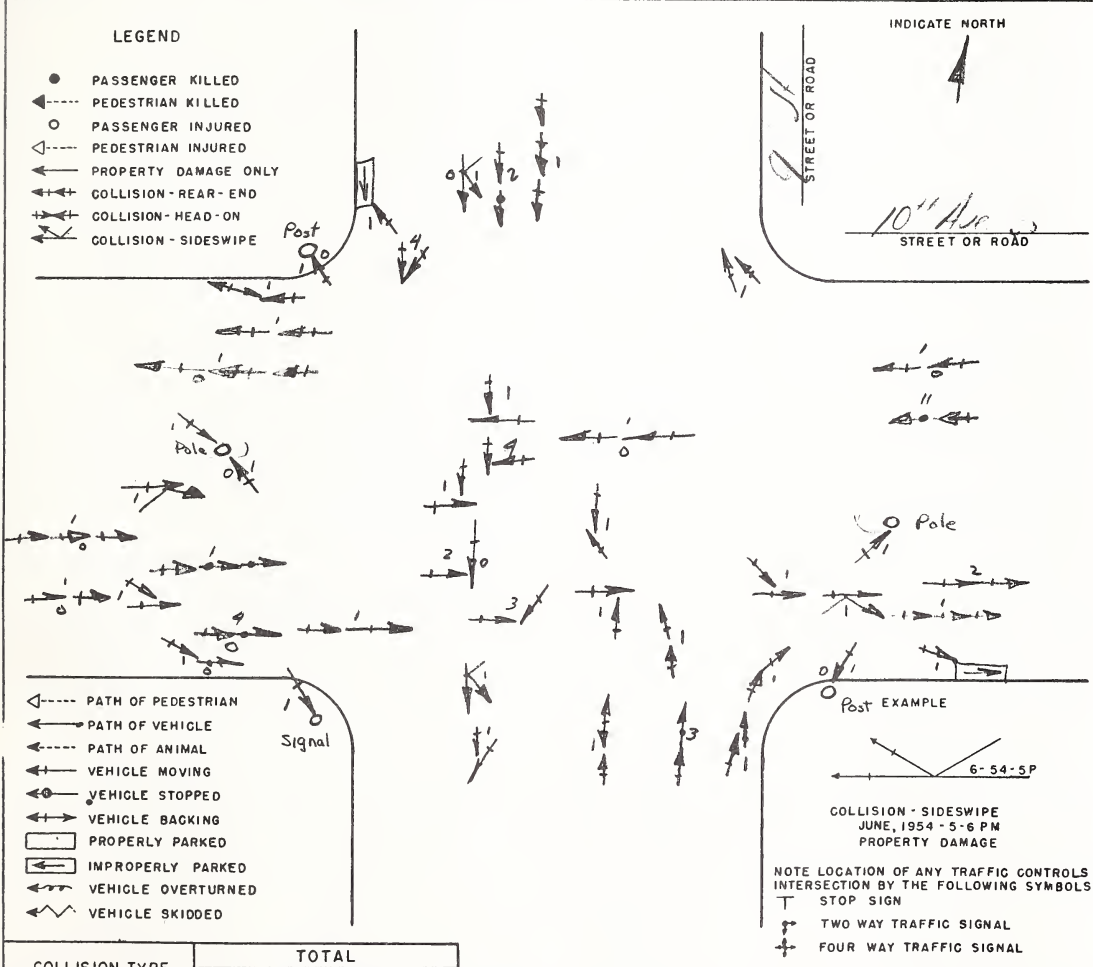
CITY OF G. Falls COUNTY Cascade

INTERSECTION OF 10th Ave. So. AND 9th St.

HIGHWAY NUMBER

PERIOD COVERED 66 67 68

COMPILED BY DRAWN BY DATE



COLLISION TYPE	TOTAL			
	FATAL	INJURY	PROP DAMAGE	TOTAL
ANGLE		1	8	9
HEAD - ON				
REAR - END		7	29	36
SIDESWIPE		1	1	2
TURNING MOVEMENT			16	16
PARKING				
NON - COLLISION				
FIXED OBJECT		3	3	6
PEDESTRIAN				
BACKING			2	2
MISC.				
TOTAL		12	59	71

REMARKS

In any of the collision diagrams (1-15) the number by a collision represents the number of that type of accident. The "0" represents a person injured in one of the accidents. Do not add the number of "0" to the number to obtain number of accidents.

EX



one accident Five injuries



five accidents one injured

MONTANA HIGHWAY COMMISSION

TRAFFIC DEPARTMENT

ACCIDENT ANALYSIS

COLLISION DIAGRAM

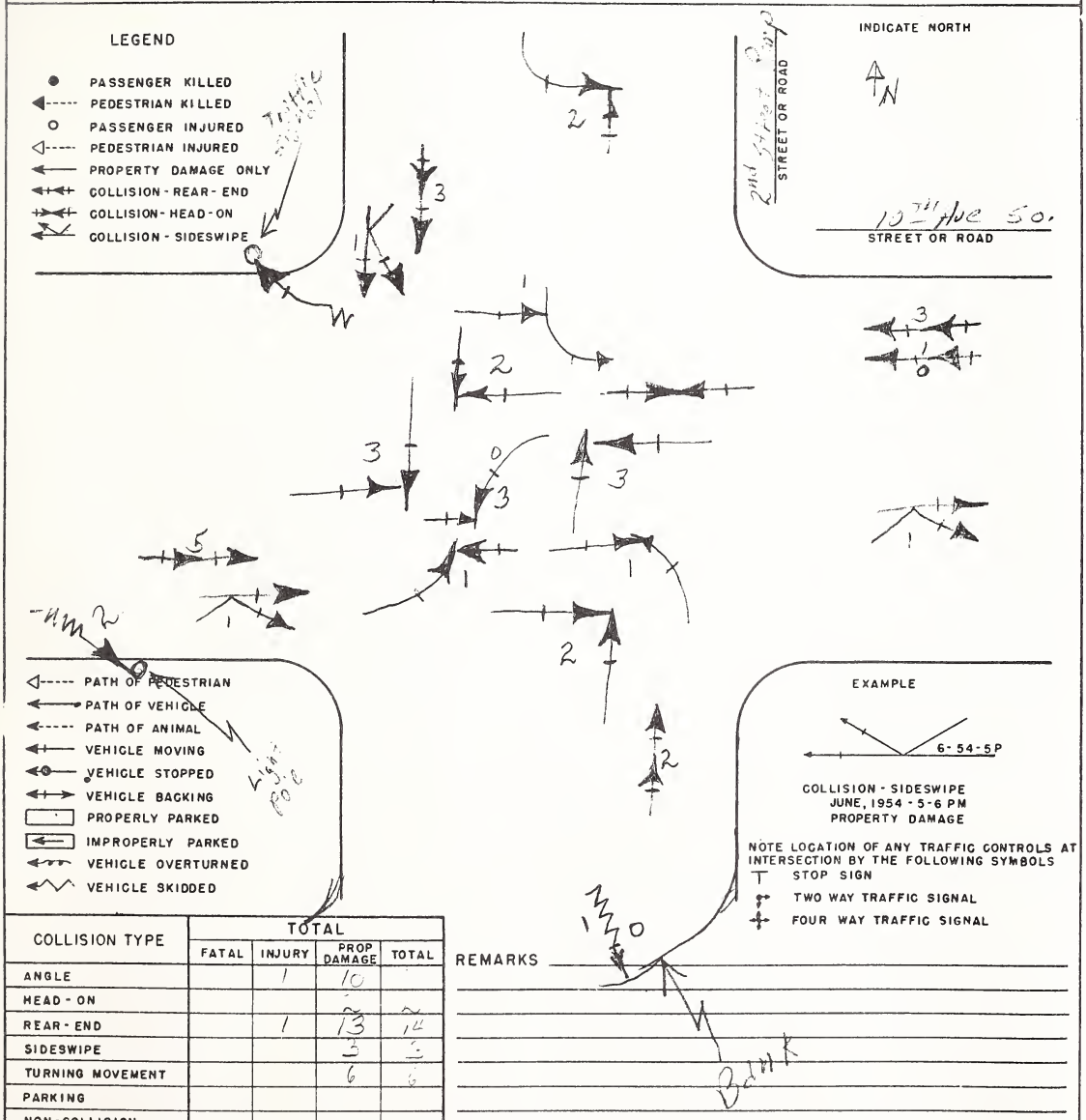
CITY OF _____ COUNTY _____

INTERSECTION OF _____ AND _____

HIGHWAY NUMBER _____

PERIOD COVERED _____

COMPILED BY _____ DRAWN BY _____ DATE _____



COLLISION TYPE	TOTAL			
	FATAL	INJURY	PROP DAMAGE	TOTAL
ANGLE		1	10	
HEAD - ON				
REAR - END		1	13	14
SIDESWIPE			5	5
TURNING MOVEMENT			6	6
PARKING				
NON - COLLISION				
FIXED OBJECT		1	1	2
PEDESTRIAN				
BACKING				
MISC.				
TOTAL		3	37	40

REMARKS _____

MONTANA HIGHWAY COMMISSION

TRAFFIC DEPARTMENT
ACCIDENT ANALYSIS

COLLISION DIAGRAM

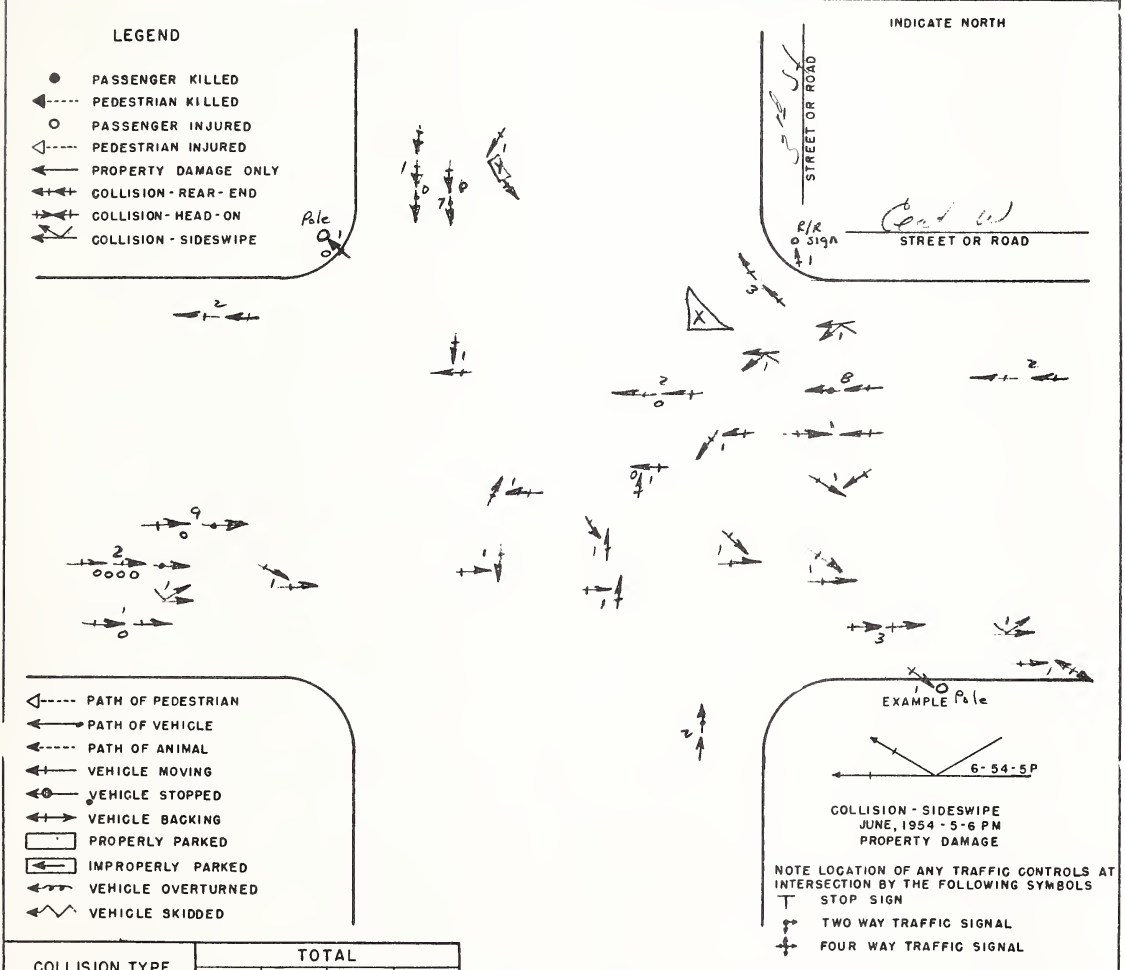
CITY OF Gt Falls COUNTY Cascade

INTERSECTION OF Cent. W. AND 3rd St.

HIGHWAY NUMBER _____

PERIOD COVERED 66 67 68

COMPILED BY _____ DRAWN BY _____ DATE _____



COLLISION TYPE	TOTAL			
	FATAL	INJURY	PROP DAMAGE	TOTAL
ANGLE		1	3	4
HEAD - ON			1	1
REAR - END		6	36	42
SIDESWIPE			4	4
TURNING MOVEMENT			8	8
PARKING				
NON - COLLISION				
FIXED OBJECT		1	2	4
PEDESTRIAN				
BACKING			1	1
MISC.				
TOTAL		8	55	63

REMARKS

X concrete islands

Y mobile home

MONTANA HIGHWAY COMMISSION

TRAFFIC DEPARTMENT

ACCIDENT ANALYSIS

COLLISION DIAGRAM

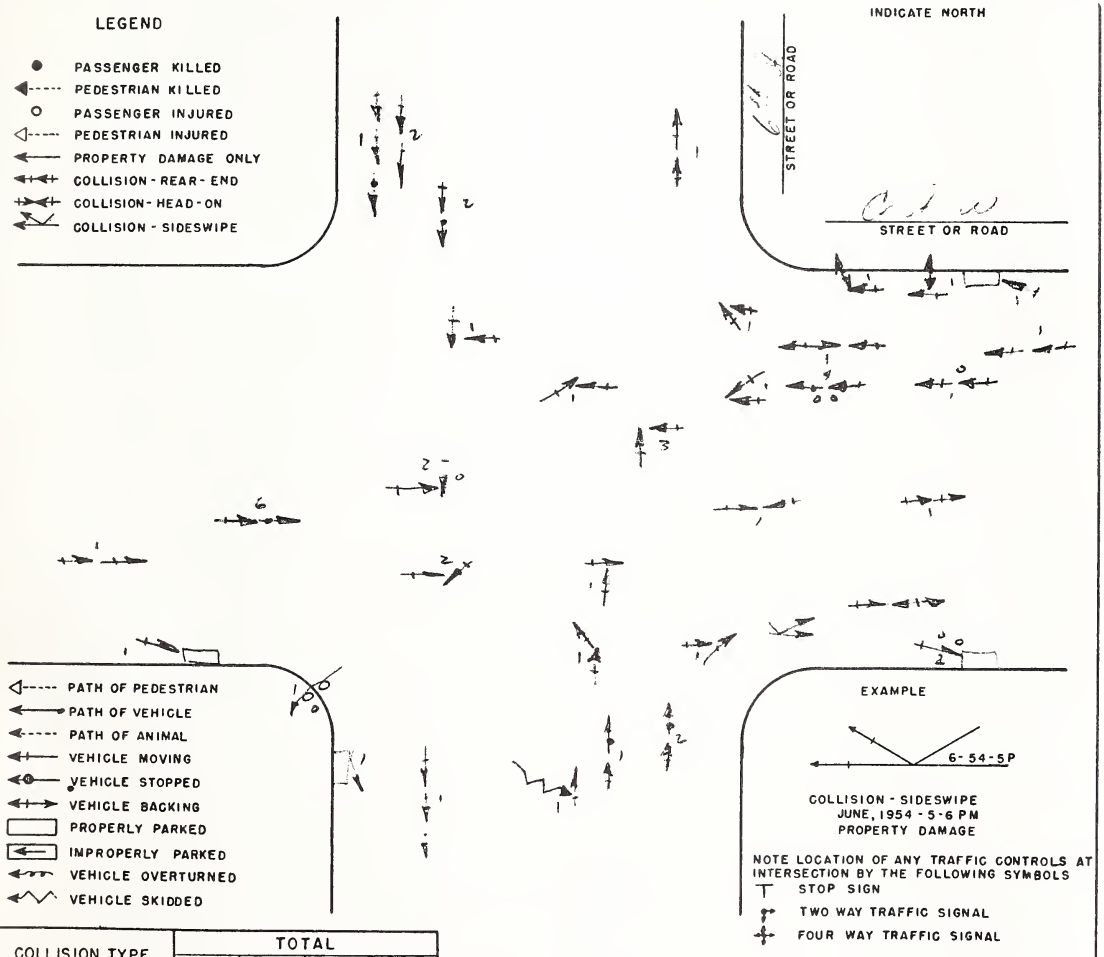
CITY OF G Falls COUNTY Cascade

INTERSECTION OF Cent W AND 6th

HIGHWAY NUMBER

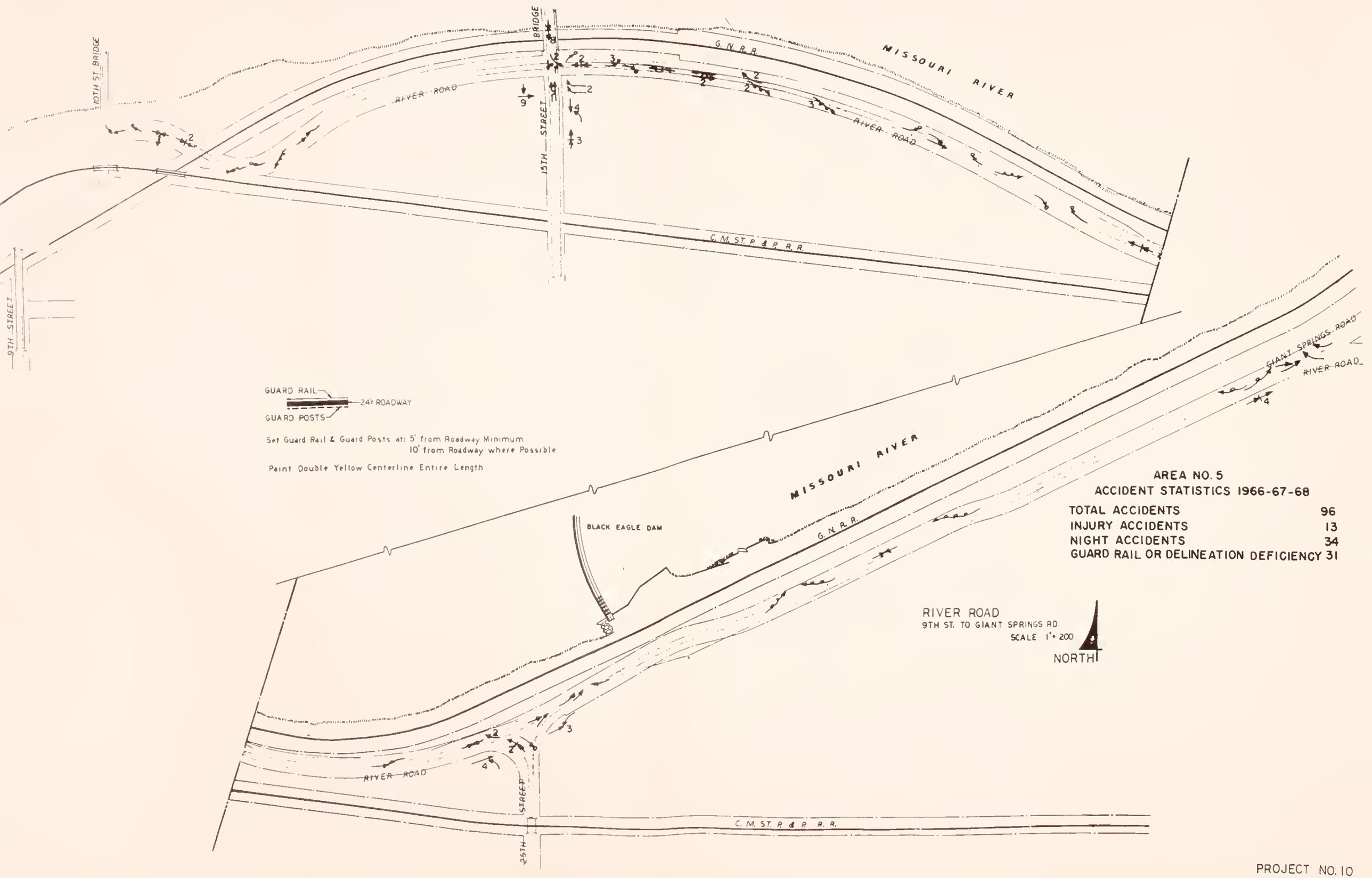
PERIOD COVERED 66 67 68

COMPILED BY DRAWN BY DATE



COLLISION TYPE	TOTAL			
	FATAL	INJURY	PROP DAMAGE	TOTAL
ANGLE		1	7	8
HEAD - ON			1	1
REAR - END		4	22	26
SIDESWIPE			2	2
TURNING MOVEMENT		1	8	9
PARKING				
NON - COLLISION				
FIXED OBJECT				
PEDESTRIAN				
BACKING			4	4
MISC.		1		1
TOTAL		7	44	51

REMARKS



AREA NO. 5
ACCIDENT STATISTICS 1966-67-68

TOTAL ACCIDENTS	96
INJURY ACCIDENTS	13
NIGHT ACCIDENTS	34
GUARD RAIL OR DELINEATION DEFICIENCY	31

RIVER ROAD
9TH ST. TO GIANT SPRINGS RD.
SCALE 1" = 200'
NORTH

PROJECT NO. 10